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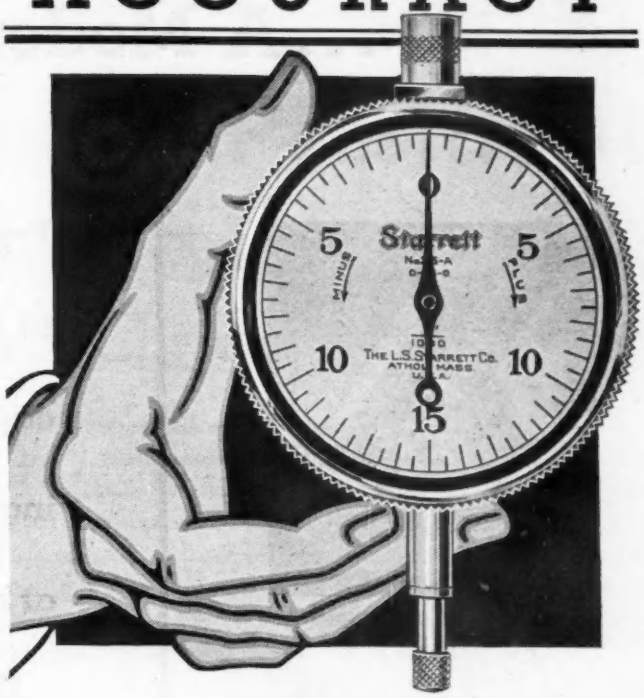

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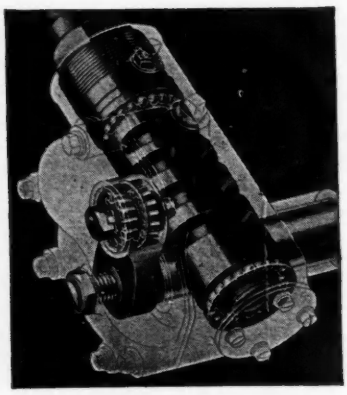

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AUTOMOTIVE INDUSTRIES

Vol. 73, No. 4 ▫ THIRTY-SEVENTH YEAR ▫ July 27, 1935

Keller Is Chrysler President

Summer Sales Firm; Estimate 325,000 Deliveries in July

Midsummer firmness in retail sales of motor vehicles is removing fear of any very serious clean up problem before the new model season arrives. At least that is true of the major producers which suggests that no important price changes are in the offing to disturb the retail market. If any unfavorable inventory position exists among the dealer organizations, such is believed to be of minor nature and not likely to influence the price structure even if some distress selling developed. Heavier trade in allowances rather than reductions in list prices are expected to prove adequate in moving remnants of the current lines.

If demand holds up to expectations, a number of leading dealer bodies are looking forward to a perfect cleanup and may even experience a shortage before new models are on the market. This situation will serve as an aid in unloading such surpluses as might exist in other quarters. Some stocks already are unbalanced as to body types and dealers with an eye to the August plant closings are placing fill-in orders with the factory. One of the big manufacturers has found a rather insistent demand of this sort lately and has had to step up production to meet it.

Latest figures disclose that the retail volume is holding at a level seasonally under that of June when estimated domestic deliveries were in the neighborhood of 325,000 cars and trucks. Less than a 7 per cent decline from this figure is indicated by reports coming in for July. As yet the approaching new model season has had little effect on sales, although some claim that they are beginning to sense a little resistance from that source.

(*Turn to Page* 122, *Please*)

Hutchinson, Zeder and Davies Promoted; Chrysler Heads Board

"These men with their associates in the management of the Chrysler Corp. have been chiefly responsible for the position occupied by the corporation today, not only in the automobile industry but as one of the leading industrial enterprises of the United States. They typify the group whose ability as an organization has been responsible for the growth of the company .... It is time the public has an opportunity to know the men who really manage this business and I am happy to see them begin to get the recognition they deserve in these promotions."

With this tribute, Walter P. Chrysler announced this week that:

K. T. Keller, vice-president and general manager in charge of all Chrysler Motors production, had been named president of the corporation, succeeding Mr. Chrysler.

B. E. Hutchinson, vice-president and treasurer, who has directed the corporation's financial affairs since Mr. Chrysler took over Maxwell in 1921, had been appointed chairman of the finance committee.

Fred M. Zeder, vice-president in charge of engineering, regarded by Mr. Chrysler as the greatest engineer in the industry, had been elected vice-chairman of the board.

H. A. Davies, assistant treasurer, would succeed Mr. Hutchinson as treasurer.

Although relinquishing the presidency, Mr. Chrysler continues as chairman of the board and directing head of the business.

In Detroit, it is felt that these promotions do not mean any changes in operations or management, but simply crystallize in terms of titles an executive set-up that has been functioning for some time past. The operations committee of 14 members, which includes the presidents and general managers of the units together with the vice-presidents of the Chrysler Corp., it is understood, continues with Mr. Keller as chairman as formerly. It is possible that some new members may be added to this committee following these promotions.

Mr. Keller's connection with the industry dates back to 1909 and his association with Chrysler Motors to 1926. He was born at Mount Joy, Pa., in 1885. Following an ap-

(*Turn to Page* 122, *Please*)

"The men who really manage this business"

Fred M. Zeder K. T. Keller B. E. Hutchinson

First Half Production 2,373,471; 6 Mos. Total Largest Since 1929

The industry produced more motor vehicles in the first half of this year than in any similar period since 1929. The six-month total for the United States and Canada was 2,373,471 against 1,796,347 in the first half of 1934, an increase of 32 per cent.

The Census Bureau puts June output at 377,065 units made up of 308,885 cars and 68,180 trucks. This compares with the May total of 385,492 which was the sum of 324,615 cars and 60,877 trucks. In June last year the industry built 272,090 cars and 48,292 trucks for a total of 320,382 units.

Of total June production, 276,546 cars and 50,649 trucks went into the domestic market which compares with estimated registrations in that month of 275,000 new cars and 47,000 new trucks, indicating no important change in field inventories during the month.

In the first half, the number of new cars going into the domestic market exceeded estimated registrations by about 275,000, while the number of trucks for the domestic market exceeded registrations of new trucks by about 60,000. These differences probably exaggerate the increases that have taken place in dealer inventories since the first of the year due to the lag in registration reports and other causes.

Sales to foreign markets excluding Canada were 139,179 cars and 76,431 trucks in the first six months.

Comparative figures follow:

	Cars	Trucks	Total
Production—U. S. and Canada			
June, 1935	308,885	68,180	377,065
May, 1935	324,615	60,877	385,492
June, 1934	272,090	48,292	320,382
6 Mos., 1935	1,962,819	410,652	2,373,471
6 Mos., 1934	1,469,285	327,062	1,796,347
Sales to U. S. Market			
June, 1935	276,546	50,649	327,195
May, 1935	285,671	45,790	331,461
6 Mos., 1935	1,733,252	313,282	2,046,534
Sales to Foreign Market*			
June, 1935	20,063	14,062	34,125
May, 1935	21,851	11,415	33,266
6 Mos., 1935	139,179	76,431	215,610
Canada			
June, 1935	12,276	3,469	15,745
May, 1935	17,093	3,672	20,765
June, 1934	10,810	3,095	13,905
6 Mos., 1935	90,388	20,939	111,327
6 Mos., 1934	67,084	15,000	82,084

* Exclusive of Canada.

Mitchell Specialty Elects E. K. Williams President

Ernest K. Williams has been elected president and director of the Mitchell Specialty Co., Philadelphia. Mr. Williams succeeds J. J. Seitz, who died about two weeks ago. The new president joined the Mitchell organization about four years ago as sales engineer and two years ago was named assistant to the president. During Mr. Seitz's illness prior to his death, Mr. Williams was the company's acting president.

Body Styles Follow Price Range, Pontiac Study Shows

Studies made by the Pontiac sales department indicate that body styles follow the price range and colors predominate according to body types and territorial locations, according to A. W. L. Gilpin, vice-president and general sales manager of the company.

Company statistics show that approximately 40 per cent of Pontiac production and sales thus far this year has been eights, the balance being divided between the six and deluxe six. According to Mr. Gilpin the general rule is that the larger the population center the greater the percentage of eight cylinder car sales. One changing model trend is the ratio between sedans and touring sedans with trunks between the sixes and eights. Mr. Gilpin said the company's study of this subject showed there are twice as many four-door sedans as there are touring sedans in the six line, while among the deluxe six models the proportion is much more equal.

In the matter of colors the purchaser has a choice of seven standard colors with one additional at extra cost. Black remains the most popular with a total of 45 per cent of all models, the darker shade of blue takes precedence over the lighter shade. Brown is more popular on the Pacific Coast than in any other section of the country. The cream color, the extra at additional cost, has been most popular for the sport coupes and cabriolet models.

June Retail Financing Volume Gains Over '34

The dollar volume of retail financing of new passenger automobiles shows an increase of 1.5 per cent for the month of June as compared with June, 1934, and an increase of 62 per cent compared with June, 1933, according to preliminary estimates by the Department of Commerce. As compared with May, 1935, there was an increase of about 1.5 per cent.

The aggregate volume for the first six months of this year was 21 per cent above the first six months of 1934 and 121 per cent higher than the corresponding period of 1933.

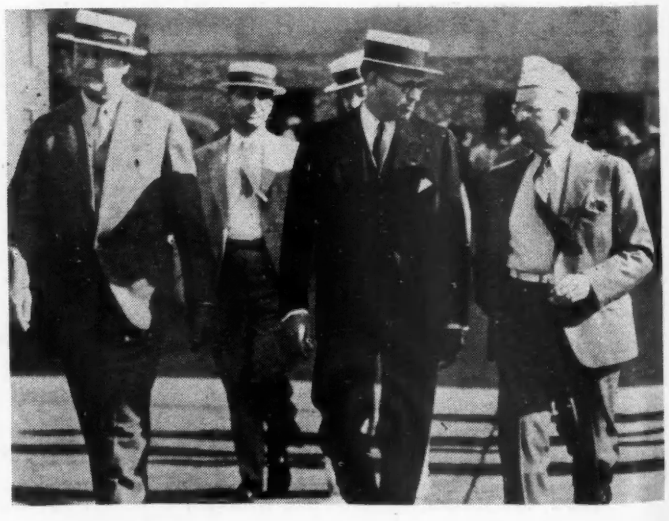
Comparison of June of this year with the same month of previous years shows, according to the Commerce Department's report, that while last month's retail financing volume was 85.7 per cent greater than that of June, 1932, it still lagged 23.3 per cent behind the same month of 1930 and 43 per cent behind June, 1929.

Denham Joins Schipper

Schipper Associates announces the acquisition of the Denham Technical Advisory Service which will be continued as a part of the expanded functions of this organization. Athel F. Denham who recently resigned as Detroit editor of the Chilton publications to form the Advisory Service joins Schipper Associates in an executive capacity. He will make his headquarters in Detroit.

Budd Wheel Co.

First half net profit of Budd Wheel Co. is reported as $516,560. This compares with a net profit of $148,609 in the first six months of 1934.



Governor Frank D. Fitzgerald of Michigan was the first visitor at an Oldsmobile open house celebration in Lansing. From left to right are shown J. J. Carter, assistant general manager of Oldsmobile; Mayor Max Templeton, of Lansing; Governor Fitzgerald, and C. L. McCuen, Oldsmobile president.

Parking meters along Oklahoma City's main street. The motorist must place a coin in the meter when he parks, the time of parking is then registered and, it is said, saves many arguments with the police.

Metal Show Scheduled For Chicago Sept. 30

Leaders in the metal world will take an active part in the technical program for the 17th National Metal Congress and Exposition, to be held in Chicago the week of September 30. The societies participating in this year's show are the American Society for Metals, the American Welding Society, the Wire Association, and the Institute of Metals Division and the Iron and Steel Division of the American Institute of Mining and Metallurgical Engineers.

There will be sessions devoted strictly to research and others dealing with practical shop problems, service tests of materials, melting practice, tool steels, and alloys. The program is so arranged that visitors to the Congress will be able to attend all the sessions in which they are particularly interested. More than 160 exhibitors have reserved space at the exposition. All the important steel companies, most of the nonferrous producers and makers of machines and methods used in the metal industry are expected to be represented at the coming show.

Aircraft Propeller Brake Developed by US Engineer

A new hydraulic brake for multi-engined planes, invented by Raymond B. Quick, an engineering inspector for the Bureau of Air Commerce, has been developed for practical use in collaboration with engineers of Sikorsky Aircraft and has been placed in regular service on the Sikorsky S-42 of Pan American Airways. Operation of these brakes is as follows:

Arsta oil is pumped manually from a 2-quart tank through a check valve into an accumulator which works against springs. The accumulator will stand a maximum safe pressure of 2000 lb. per sq. in. There is a shut-off valve in the main line to the control valves for the four propellers, and when this shut-off valve is opened oil passes to the four control valves. Any control valve can be opened singly or all may be opened together. When the control valve is opened, oil passes into a cylinder mounted on the engine nose section. The cylinder contains two pistons which are forced apart by the oil pressure, and they in turn force Raybestos-lined brake bands against the brake drum, which latter is machined from a steel forging with integral cooling fins, and is bolted to the propeller hub. The brake shoe is hinged to the nose section. A spring connected to the brake bands at the cylinder retracts the pistons when the oil pressure is released.

The entire brake installation on the Sikorsky, involving four propellers, weighs only 55 lb., and we are informed that the installation has proven so satisfactory that Sikorsky Aircraft is contemplating its use on all future models.

Propeller brakes on aircraft have the advantage of permitting lower landing speeds; they make possible correction for the loss of power from one engine by the use of the rudder alone, instead of the conventional use of both rudder and ailerons, and in the event of breakage of some engine part, they permit of immediate stopping of the engine, thereby preventing its possible complete destruction.

P & W to Designate Engines by Cruising Power Rating

Hereafter all Pratt & Whitney commercial aircraft engines will be designated by their "cruising rating" instead of by the maximum power available for limited periods only. This change was decided upon because airplane cruising performance, the basis of all airline schedules, is dependent upon the available cruising power of the engines and not upon the power which the particular engine can produce on a dynamometer for a limited period.

Edelmann Enlarges Plant

E. Edelmann & Company, Chicago, manufacturers of automotive accessories, are adding approximately 25,000 sq. ft. of floor space to their factory on Logan Boulevard. It will be of reinforced concrete construction and will cost approximately $75,000.

Chrysler Profits Up 128% To Spend $7,000,000 for Plant Improvements

The combination of the largest unit volume in the history of the corporation and relatively lower costs and expenses, lifted Chrysler net earnings in the first half of the current year to $18,659,310 against $8,192,084 in the corresponding period last year, an increase of 128 per cent.

Volume increased 28 per cent in the first half while unit sales to dealers increased 26 per cent. Costs rose 24 per cent but expenses increased but 7 per cent.

Profits in the second quarter amounting to $9,496,127 were slightly larger than the first quarter total of $9,163,182, and were more than double 1934 second quarter earnings of $4,345,788. Second quarter sales, however, were under the first quarter—$145,619,905 to $149,949,991.

First half profits are after a non-recurring charge of $1,507,525, the premium paid in connection with the redemption of the Dodge debentures on May 1.

An extra dividend of 25 cents per share will be paid in third quarter which will make the distribution to stock holders 50 cents per share. An extra of the same amount was paid in the second quarter.

The directorate, of which Walter P. Chrysler, Jr., is now a member, also appropriated $7,000,000 for the improvement of plant facilities.

Despite the large unit sales in the first half, Mr. Chrysler said that stocks of cars in dealers' hands were about the same at the end of June as they were a year ago.

Mr. Chrysler also revealed that the corporation had adopted the policy of distributing depreciation charges over the four quarters of the year on the basis of unit production in a manner similar to that in which tool amortization charges have always been treated. Formerly depreciation was divided among the quarters on the basis of 25 per cent of the annual rate.

Some of the important figures from the corporation's half-year report follow:

	First 6 Mos. 1935	First 6 Mos. 1934
Unit sales	487,157	387,684
Sales	$295,569,896	$231,103,779
Cost of sales	251,187,188	202,412,493
Expenses	20,657,928	19,273,475
Net income	18,659,310	8,192,084
Depreciation	13,656,521	7,717,146
Cash	65,285,978	31,460,666
Securities	6,242,124	955,176
Inventories	24,559,733	37,533,616
Total current assets	107,886,746	87,088,519
Total current liabilities	42,069,153	37,686,371

Chrysler Buys License Under Jaray Streamline Patent; Suit Is Settled

NEW YORK, July 25—Announcement was made here today by the Jaray Streamline Corporation of America that the Chrysler Corporation has purchased a license under U. S. Patent No. 1,631,269 and export rights under corresponding foreign patents controlled by the former. This patent, commonly known as the Jaray Streamline Patent, has been described as basic as covering efficient streamlining of all automotive vehicles, including passenger cars, buses, trucks and rail cars. The patent was granted in 1927 to Paul Jaray, who is said to have been chiefly responsible for the streamlining of the German Zeppelins.

The agreement reached between the Chrysler and Jaray Corporations effects a settlement of a suit for patent infringement brought by the latter against the former in the United States District Court, Eastern District of New York, on May 24.

Negotiations which resulted in the agreement and settlement with Chrysler have been conducted, on the part of Jaray, by Lowell H. Brown, president of the Jaray Corporation, and John Harness, in charge of the Chrysler patent department. They were greatly facilitated, however, by Walter T. Fishleigh, an independent consulting engineer and patent expert of Detroit, acting on behalf of Chrysler. It is understood that, after being retained by Chrysler to study the patent and assist in defense of the suit brought by Jaray, Mr. Fishleigh recommended a settlement and was quite largely instrumental in bringing it about. The agreement covers Plymouth, Dodge and DeSoto as well as Chrysler.

Chrysler officials told an *Automotive Industries* representative they had no comment to make upon the Jaray matter.

Paul Jaray, a Hungarian by birth, was connected with the Zeppelin Airship Works in Friedrichshafen, Germany, from 1914 till 1923. During the early "twenties" he was chief engineer and head of the new-projects division. One of the projects on which he worked was that of the development of the advantageous forms for Zeppelin airship hulls from the aerodynamic standpoint. In this way he became very much interested in what are now known as streamline forms. In 1921 Jaray presented to the general manager of the Zeppelin Works a design for a streamlined automobile body, the Zeppelin Works at that time having under consideration a plan to take up the manufacture of automobile bodies. The first application for a German patent was made in September, 1921, and it is stated that this first patent is the master patent covering the streamlined form of automobile as conceived by Jaray, and that there have been no fundamental changes in Jaray's views with respect to body forms of minimum air resistance since that time, for although additional patents were applied for later, they only developed the same ideas further.

The claims of the patent covered a motor vehicle of such form that the whole of the powerplant, the passenger compartment, the baggage compartment, and the running gear, including the wheels, are so enclosed that half of a streamlined body results, the substantially plane bottom of which is practically parallel to the road surface, and upon which there is superposed another half streamlined body as windshield for the head of the driver, this latter body being of such form that the air flow created by the motion of the car passes off over the back of the assembly.

The chief idea underlying all of Jaray's work seems to be the combination of streamlined surfaces of revolution with plane surfaces close to the ground. This form, of course, was arrived at as a result of experience in wind-tunnel tests.

Generator Output Control Developed by Plymouth

A fundamental improvement in the method of controlling the output of automobile generators, designed to increase the life of batteries, light bulbs and ignition breaker points, has been developed by Plymouth.

The improvement involves the use of a new "voltage control" device which automatically adjusts the generator output to fluctuating "loads" on the electrical system and the varying requirements of the battery.

Heart Attack Fatal To Ashton G. Bean

White President and Studebaker Director Dies at Elyria Home

Ashton Garrett Bean, chairman of the board of White Motor Co., president of Bishop & Babcock Co. and a Studebaker director, died at his Elyria, Ohio, home Saturday, July 20. Mr. Bean's death resulted from an attack of heart disease. He was 63 years old.

Prior to 1931, when he was invited to assume the presidency of White, Mr. Bean had no previous experience in the automobile industry. The Bishop & Babcock organization, which he headed, manufactured bottling machinery and similar apparatus. Mr. Bean succeeded Robert W. Woodruff, who was then serving both White and the Coca-Cola Co. as president. The arduous duties of the dual office forced Mr. Woodruff to relinquish the White post.

Ashton G. Bean

In his first year as White president Mr. Bean is credited with saving the company $3,000,000 through a judicious adjustment of income and outgo of money without impairing research and development work within the organization. During that first year he was instrumental in securing for the company one of the largest orders ever signed for heavy-duty trucks—774 trucks for New York City.

When Studebaker entered its friendly receivership in March, 1933, Mr. Bean was selected as a receiver along with Paul Hoffman, now Studebaker president, and Harold S. Vance, chairman. During the receivership much of Mr. Bean's time was spent on trains shuttling back and forth between

GM's Allison Division to Build 1000 H.P. Aircraft Engines in New Plant

Construction of a new plant for the production and development of liquid cooled aircraft engines is to be begun at once for the Allison Engineering Co., division of the General Motors Corp., at Speedway, Indianapolis, Ind., under a contract just awarded to The Austin Co. of Cleveland.

The plant, including four structures of modern design with welded steel construction and horizontal window areas completely encircling the buildings, will occupy a thirteen and a half acre site and provides initially for a total of 41,000 sq. ft.

Power and testing facilities covered by the present contract are large enough to service manufacturing units three times the size of the unit now to be established, and provisions have been made to permit expansion with maximum ease as business warrants.

The aircraft engines to be constructed in the Speedway plant will be of 1000 h.p.—the most powerful aviation units made in this country. They have been under development for several years.

The four buildings in the project include:

1. Manufacturing unit, 122 by 251 feet, giving 31,000 feet of floor space, brick and steel.

2. Engine test unit, 50 by 122 feet, concrete and steel.

3. Carpenter shop, dychromating and steel storage unit, 50 by 90 feet.

4. Power-house, 32 by 32 feet, brick and steel.

The manufacturing unit will house the machine shop, electric furnace room, paint shop and shop offices. Equipment will be of the most modern type, one of the features being monorail hoists and a traveling crane, each individually electrically operated.

The new plant is designed to permit air conditioning at a later date. The contract includes the grading and seeding of the grounds with a view to later landscaping.

Cleveland and South Bend. The rigors of this work sapped his energy and impaired his physical condition. Last April Mr. Bean resigned the White presidency and became chairman of the board. Robert F. Black succeeded him.

At the time Mr. Bean was invited to take the presidency of White he was in the African jungles on a big game hunting expedition. He always had been interested in sports, particularly boxing, and was reported to be an amateur boxer of considerable ability.

Packard Earns First Half Net Profit of $290,460

Packard Motor Car Co. and subsidiary companies report for the three months ended June 30 a net profit of $1,500,622 which compares with a net loss of $1,711,123 in second quarter of last year. For the six months ended June 30 a net profit of $290,460 is reported which compares with a net loss of $2,968,144 in corresponding period of 1934. Factory sales for six months ended June 30 totaled $21,495,727 compared with $6,422,537 in the first half of 1934.

Current assets as of June 30 totaled $19,987,405 which included cash, United States Municipal Securities and Canadian bonds. Its current liabilities were $5,658,571.

Packard production by months of the 120 line was: Jan., 0; Feb., 67; March, 2251; April, 4358; May, 5069; June, 6071; total, 17,816. The twelfth series output was 3561, making an aggregate total of 21,377 for the January-June period this year.

Alvan Macauley, president, stated "we do not believe a quicker job of getting into profitable production with a new car was ever before accomplished." On January 1, 1935, the factory that was set aside for production of the "120" was still vacant space, and most of the machine tools and facilities had still to be received from the manufacturers who produce them. There was considerable delay because many of the tools were special to our requirements and others were entirely new in principle. Despite handicaps we produced the first "120" through our regular manufacturing facilities on February 16, 1935.

"In this showing of profits we must not fail to give due credit to the sales of Twelfth Series cars. They were an extremely important element in enabling us to make a record that we can view with considerable satisfaction."

1936 Indianapolis Rules Cut Fuel Allowance and Permit Superchargers

A direct bid for foreign competition, further fuel restrictions and the adoption of important safety measures for the protection of drivers were the results of the annual rules committee meeting held in Detroit Monday to formulate regulations for the conduct of next year's 500-mile automobile race at the Indianapolis Motor Speedway May 30.

In reducing the fuel allowance from 42½ gallons to 37½ gallons, five gallons less than last year's requirements, the rules committee of the Contest Board of the American Automobile Association also threw out all engine restrictions, particularly those applying to superchargers.

The rule against superchargers is said to have stifled European invaders for several years because racing cars on the other side of the Atlantic have been using this motor stimulation for many years and have been reluctant to change their motor equipment. The last invasion of European cars at Indianapolis was in 1930.

A further gasoline reduction in the qualifying 25-mile trial runs before the race was ordered. Last year cars were allowed three gallons with the tolerance of a pint. Next year they will be allowed only two and a half gallons for the elimination test.

The safety measures adopted apply particularly to new drivers and new cars. Drivers unfamiliar with the track now will be required to make apprentice runs over a distance of 125 miles at speeds gradually stepped up from 80 miles an hour to 110 miles an hour. These tests will be supervised by a committee representing the Contest Board, the Speedway and the drivers themselves. The newcomer, regardless of his reputation on other tracks, will be required to first drive ten laps at 80 miles per hour, then ten laps at 90 miles per hour, ten laps at 100 miles per hour, ten laps at 105 miles per hour and finally ten laps at 110 miles per hour. This will be an absolute requirement before the new driver is allowed to qualify.

New cars making their first appearance at the Indianapolis Motor Speedway or old cars which have been remodeled in such a fashion as to be considered changed fundamentally will be subjected to the same 125-mile test under the supervision of the technical committee.

The Indianapolis Motor Speedway will further set up a laboratory next year, equipped with an X-ray machine to examine all steering knuckles and other car parts subjected to strain and stress and these parts must have been examined and approved by the technical committee before the cars are allowed on the track for even practice runs.

Kelly Petillo, who won the last 500-mile race at an average speed of 106.24 miles per hour, used 40.125 gallons of fuel for the 500-mile run, an average of 12.6 miles per gallon. He would not have finished under the new restrictions.

The minimum weight restriction of cars was also reduced from 1950 pounds to 1800 pounds and the previous rule which required cars to weigh in at a ratio of seven pounds per cubic inch of motor piston displacement was abandoned.

No Supercharger Failures In 40,000,000 Miles

Forty million miles of driving in the hands of some three thousand owners without a single internal failure or a single unit wearing out, is the performance record reported during the past 18 months for the Graham supercharger. Service records at the Graham factory are said to show that supercharger-equipped cars not only exceed in economy and performance virtually identical cars without blowers, but also excel them in freedom from engine service troubles. Among other things it is claimed that the supercharger has been effective in increasing main bearing life, in preventing connecting rod bearing failures, and in eliminating valve burning and pitting.

Chicago Automobile Show Location Still Undecided

H. T. Hollingshead, chairman, and K. K. Kenderdine, president of the Chicago Automobile Trade Association, say that the Chicago Automobile Show location has not been determined, but under consideration are the International Amphitheater at the Union Stock Yards, the Navy Pier, Hotel Stevens, Coliseum and the Chicago Stadium. The show is scheduled for Nov. 23 to 30.

In addition to Mr. Hollingshead, who represents Nash-Lafayette, the show committee will include W. R. Bellows, Packard; I. B. Burestine, Chrysler; W. E. Butler, Hudson-Terraplane; A. H. Crowley, Lincoln; S. L. Davis, Hupmobile; V. C. P. Dreiske, Cadillac-La Salle; C. L. Gerds, Dodge; Thomas J. Hay, Reo; D. P. Hogan, Dusenberg; Lloyd Johnson, Auburn; R. H. Keeling, Studebaker; Harry Lewis, Chevrolet; H. E. Mahaffey, De Sota-Plymouth; W. J. Mougey, Pontiac; E. J. Pillinger, Oldsmobile; A. H. Russell, Pierce-Arrow; B. G. Sykes, Graham; Norman Walters, Buick, and Frank Yarnall, Ford.

GM First Half Earnings $83,729,838; Increased $14,643,225 Over Year Ago

Net income available for dividends of the General Motors Corp. in the second quarter amounted to $52,219,467 against $31,510,371 in the first quarter and $40,267,090 in the second quarter of last year.

In the first six months of the year, the corporation earned $83,729,838 against $69,586,613 in the same period last year.

After preferred dividends of $2,294,555 in the second quarter, there remained $49,924,912 applicable to the common, the corresponding figure last year being $37,972,535. For the first half, after preferred dividends of $4,589,110, there was $79,140,728 for the common against $64,997,503 in the first six months of 1934. On a per share basis common earnings were $1.17 in the second quarter and $1.85 for the first half against 88 cents and $1.51 respectively last year.

Net sales in the second quarter were $343,209,087 against $309,706,468 in the same quarter last year. First half sales totaled $594,883,990 as compared with $519,677,906 in the corresponding 1934 period.

Open Bidding Restored on Motor Steel Requirements; Ford, GM Inquiries Out

With sheet and strip producers figuring on round tonnages to be supplied to leading motor car manufacturers over the remainder of the year, the last vestige of what remained of Code marketing methods seems to have been definitely swept away. While gratifying that Ford puts out at this time of the year an inquiry for 100,000 tons of flat steels, the tonnage entailed is not nearly so impressive as the fact that open market methods have once more been restored and that steel producers have accepted the invitation to bid on whatever part of the business they may be interested in. General Motors is also reported to have made inquiries for good-sized tonnages.

Up to a few weeks ago, one heard constantly in the steel market of the filing of fourth-quarter prices in August. Obviously that ceremonial will now be dispensed with. Producers will submit their quotations and then the business will be divided among those whose offers consumers consider the most advantageous. No one looks for a greatly changed picture of the price set-up as the result of this return to natural marketing methods. There may be adjustments here and there, but on the whole going prices represent a fair basis on which to restore fair play for the workings of the law of demand and supply.

Nearly all of the steel industry's different branches that cater to automotive consumers report demand beyond their expectations for this time of the year. This holds true not only of sheet and strip finishing mills, but also of automotive alloy steel specialists, wire mills and bolt and nut plants. Makers of semi-finished descriptions of steel have had to enlarge their operations to satisfy the demand from non-integrated finishing mills.

Pig Iron—Middle West markets enjoy a steady, though by no means spectacular buying pace. There are no large orders, but there are a large number of one or two carload purchases. The movement of foundry iron by water is impressive. Prices are unchanged.

Aluminum—Steady and unchanged.

Copper—While consuming demand has tapered off, the copper market rules firm. This is largely the result of the restraint that producers imposed on themselves during the recent buying movement, when they would have had good reason to advance the price, but refrained from doing so, thereby insuring stability, even should demand recede further now. Electrolytic is quoted at 8c, delivered Connecticut point, with resellers and speculative holders refusing to undersell producers.

Tin—Sharp advances on the London Metal Exchange at the opening of the week, attended by reproaches heaped upon the International Tin Committee that it was purposely seeking to create famine conditions, so as to be able to liquidate at higher prices what remains of the buffer stocks, resulted in the market for Straits tin to open the week at 52¾c, compared with 52.55c at the preceding week's close.

Lead—Fairly active and unchanged.

Jay S. Tuthill
formerly on the editorial staff of El Automovil Americano and the American Automobile (Overseas Edition) is now associated with Edwin D. Allmendinger, export manager for automotive products

FWD 25 Years Old

July 14 marked the twenty-fifth anniversary of the founding of the Four Wheel Drive Auto Co., Clintonville, Wis., which has been developed from a small shop building custom jobs in trucks to one of the leading motor truck concerns in the United States, doing business on a world-wide basis. Walter A. Olen has been president for nearly its entire history. The FWD truck is used largely in highway maintenance in this country. It is also employed widely in the telephone and telegraph industry. No formal celebration of the silver jubilee was held.

Modern Equipment Corp. Factory at Defiance, O.

The Modern Equipment Corp., recently organized to produce gasoline and service station equipment, has a reported capitalization of $300,000. The new company's factory will be located in Defiance, Ohio, according to J. C. Markey, president. Production is scheduled to start about Aug. 1.

Directors of the corporation are: Ralph A. Ralph A. Bird, Chicago; Lester Armour, Chicago; William E. Levis, president of Owens-Illinois Glass Co.; H. E. Collin, Toledo, and Mr. Markey.

Fox Co. Buys New Plant

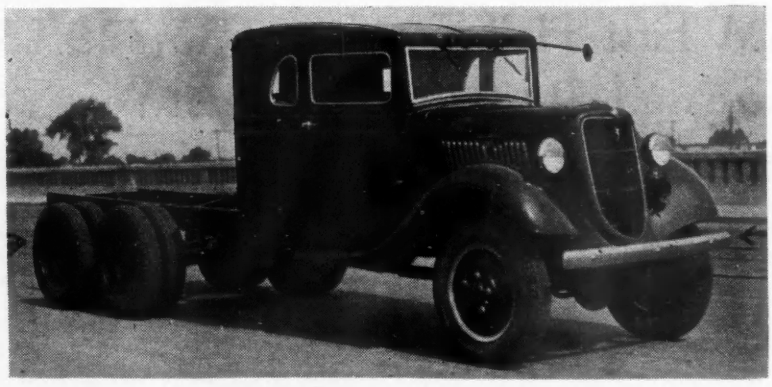
The Fox Company, Cincinnati, manufacturers of metal name plates, insignia and other metal specialties for the automobile industry, have acquired the former plant of the Davis Welding Co., in Cincinnati, and will move their entire business to the new plant when two additions, an office section and plant section, are completed. The new plant is located at 3400 Beekman Street.

Marmon-Herrington Converts Ford Truck Chassis to All-Wheel Drive

By installing a specially-designed driving front axle and propeller shaft, a two-speed auxiliary transmission and other parts, the Marmon-Herrington Company of Indianapolis has converted the Standard Ford V-8 truck into an all-wheel-drive vehicle which it is offering in various models at prices ranging below $1,500. All conversion operations are carried out in the Marmon-Herrington factory, and engineering and experimental work on these Ford conversions has been going on for several months.

The company has started production on four models, two of them four-wheel and the other two six-wheel drive. The four-wheel-drive units are the B5-4 with a 132-in. wheelbase and selling at $1,295 at the factory, and the B6-4 with 157½ in. wheelbase and selling at $1,345. The four-wheel drives have a maximum gross weight of 13,200 lb., the six-wheel drives, of 22,000 lb.

Including the all-wheel-drive Ford V-8 vehicles, the complete Marmon-Herrington line includes 28 models ranging in gross-weight rating from 8400 to more than 52,000 lb.



New Marmon-Herrington all-wheel-drive Ford V-8 truck model B5-6 with sleeper-type cab

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries

The decision of the Circuit Court of Appeals declaring the imposition of processing taxes under the AAA unconstitutional added to the uncertainties attending developments in Washington. After the decision was made public, trading in commodities was quiet; and prices moved within a narrow range in most cases. However, additional gains were made in retail trade; and merchants are optimistic regarding the prospects for fall.

Car Loadings Increase

Railway freight loadings during the week ended July 13 amounted to 566,488 cars, which marks an increase of 94,067 cars above those during the preceding week, a decline of 37,704 cars below those a year ago, and a decline of 87,173 cars below those two years ago.

Chain Store Sales Up

Sales of 23 store chain companies, including two mail order houses, during June were about 9 per cent above those a year ago. Sales of the two mail order companies alone increased almost 27 per cent.

Department Store Sales Higher

The Federal Reserve Board's adjusted index of department store sales for June stood at 80, based on the 1923-25 average as 100, as against 76 for May and 74 for the corresponding period last year.

Current Output Gains

Production of electricity by the electric light and power industry in the United States during the week ended July 13 was 7.2 per cent above that in the corresponding period last year.

Construction Contracts Up 18%

Construction contracts awarded in June were the highest for any month since March, 1934. According to the F. W. Dodge Corporation, contract awards were 18 per cent above those in May and 17 per cent above those a year ago. The total of residential building showed an increase of 10 per cent above that in the preceding month and was almost twice the volume reported in June, 1934.

More Crude Produced

Average daily crude oil production for the week ended July 13 amounted to 2,715,100 barrels, as against 2,677,400 barrels for the preceding week and 2,600,750 barrels for a year ago.

Fisher's Index

Professor Fisher's index of wholesale commodity prices for the week ended July 20 stood at 81.7, as against 81.6 the week before and 81.7 two weeks before.

Federal Reserve Statement

The consolidated statement of the Federal Reserve banks for the week ended January 17 showed no changes in holdings of discounted bills, government securities, and bills bought in the open market. Monetary gold stocks increased $4,000,000, and money in circulation declined $21,000,000.

Big Board and Curb Lists Drop Automotive Stocks

Two automotive stocks, Moto Meter Gauge and Equipment Corp. common, and Trico Products Corp. common, were dropped from the active trading list of the New York Stock Exchange last week. On the Curb Gemmer Manufacturing Co. Class A and Class B stocks and the John Warren Watson Co. common stock were suspended.

Fisher Craftsmen Winners Meet at Quebec, Aug. 21-24

Quebec will be the scene of the fifth convention of the Fisher Body Craftsman's Guild, August 21-24, inclusive, William A. Fisher, president of the educational foundation and a vice-president of General Motors, has announced.

Sixty-nine boys, some of the most skillful young craftsmen of the North American continent, will attend. These include 12 model Napoleonic coach builders, six of whom will receive $5,000 university scholarships at the annual banquet the second night, 18 regional winners selected in the apprentice class competition, and the 39 scholarship winners of previous years who form the Guild alumni.

May Pneumatic Casing Shipments Decline

Shipments of pneumatic casings for the month of May, 1935, amounted to 4,067,386 casings, a decrease of 20.9 per cent below April, and was approximately 23.7 per cent under shipments made in May a year ago, according to the Rubber Manufacturers Association.

This organization reports production of pneumatic casings for May to be 4,175,170 casings, a decrease of approximately 7.5 per cent below April and 6.3 per cent under May, 1934. Pneumatic casings in the hands of manufacturers, May 31, amounted to 11,130,764 units, an increase of 1.2 per cent above stocks on hand April 30, and practically no change as compared with stocks on hand May 31, 1934.

Lanova Corp. Opens New York Offices

The Lanova Corporation, which controls the American patents on the Lanova high-speed Diesel engine, invented by Franz Lang, has opened offices at 369 Lexington Ave., New York. A. Wielich, who has been associated with Lang ever since the latter developed the Acro engine in the early 1920's, is president of the Lanova Corporation, and among the directors are Charles Hayden of Hayden, Stone & Co.; Thomas Chadbourne of Chadbourne, Stanchfield & Levy, and Samuel Fuller of Fuller, Rodney & Co. Henry Flood, of the firm of Murray & Flood, will act as chief engineer. It is planned to let licenses for the manufacture of the Lanova engine in this country. As reported in these columns last February, the Buda Co. of Harvey, Ill., already has taken out a Lanova license.

Automatic Products Buys Aeriet Air Conditioning

The Aeriet Air Conditioning Company of Chicago has been purchased by the Automatic Products Corp., of which Vincent Bendix is chairman of the board. It was also announced that the corporation has obtained rights to a system developed by the Super-Diesel Corporation, LaPorte, Ind., by which humidity in different rooms is individually controlled, although the main pressure is from the same source. The Automatic Products Corporation has no connection with the Bendix Aviation corporation.

Willys Hearing July 27

The Federal Court hearing on the proposed sale of the Willys-Morrow plant in Elmira, N. Y., for $250,000 to Elmira Industries, Inc., has been postponed to July 27, following objections raised by the bondholders through the National City Bank, trustee.

Opens Detroit Office

Cleveland Welding Co., Cleveland, O., manufacturers of steel spoke and disc wheels, rims, etc., has opened an office at 4-147 General Motors Bldg., Detroit, with Horace A. Brown, Jr., in charge as district sales manager.

New Roxalin Office

The Roxalin Flexible Lacquer Co., Elizabeth, N. J., has established an office at 1616 Kresge Bldg., Detroit, Michigan. Roy St. John has been appointed technical sales representative in charge of the Detroit office.

Evans Gets Reading Order

Evans Products Co. has received an order for 100 auto loaders from the Reading Railroad. The dollar value of the order is approximately $50,000.

Decision Defines Repair Parts Makers' Rights; Auto-Lite Plans to Appeal

Certain disputed rights of the replacement parts manufacturers within the comprehensive boundaries of the automotive industry have been defined by the United States Circuit Court of Appeals in its decision on the Electric Auto-Lite Co.'s suit to restrain the P & D Manufacturing Co. from infringing upon patents held by the plaintiff company, unfair competition and using a trade mark similar to its own.

The suit was first heard before Judge Inch in the United States District Court in New York. Judge Inch handed down a decision in which the P & D Co. was enjoined from (a) using the words "to fit Auto-Lite" or any abbreviation thereof in connection with the sale or advertising for sale of electrical equipment or parts thereof; (b) representing or stating that parts made and sold by it fit devices or apparatus supplied by Auto-Lite; (c) from stating or representing that parts made by it and sold by it may be used for or are intended to replace Auto-Lite parts; (d) from advertising or in any way using the plaintiff company's parts numbers to identify parts made and sold by P & D; (e) from selling parts for repair or replacement of corresponding parts and devices originally manufactured by the Auto-Lite Company, except upon express condition that the proposed substitution of such P & D parts for such Auto-Lite parts be made known to the ultimate purchaser or user.

Both the Auto-Lite Co. and the P & D Manufacturing Co. appealed portions of this decision and the case came before Judges Manton, Swann and Hand. In their decision these jurists dissolved the injunction and dismissed the bill of complaint "in its entirety."

According to D. H. Kelly, executive vice-president, "Auto-Lite plans to petition the United States Supreme Court for a writ of certiorari, particularly in view of recent Supreme Court decisions extending application of doctrine of unfair competition to protect public desiring to purchase genuine parts." Mr. Kelly added that the "District Court decision holding plaintiff's combination patents valid stands."

The Court of Appeals held that the defendant "does not make or sell complete igniters, generators and motors nor the heavy and durable parts thereof. It sells replacements only for the parts which wear out and which are detachable, and for which there has been a substantial demand."

In its decision the Court stated: "The parts which the defendant sells are (1) breaker arms; (2) contact screws or brackets; (3) springs; (4) condensers; (5) rotors; (6) caps; and (7) coils. None of these parts is the essence of the inventions sued upon, nor do any constitute the part which serves to distinguish the invention, marking in itself the advance over the prior art. When the part supplied is not a component of the patented combination, there is no infringement. . . . Moreover, it has long been recognized that unpatented components of a patented combination which wear out quickly as compared with the life of the combination as a whole, may be replaced without infringement."

The Court further ruled that "it is not unfair to use the name of a well known article and label a repair part, if it be used in a fair way and simply to indicate that the part is made to fit the article. Therefore the use of the phrase 'to fit Auto-Lite' and reference to the plaintiff's corresponding numbers which describe the parts was permissible."

The original libel charged contributory infringement of five igniter patents. Validity of these patents was upheld by the lower court, but their infringement denied in the decision of the Court of Appeals, this Court saying: "The defendant never made or sold a completed unit or device covered by any of these five patents. The parts manufactured and sold by the defendant were in themselves old in the art and not covered specifically by any claim of the patent, and cannot reasonably be said to distinguish the invention for which the monopoly was granted. In the Court's opinion Auto-Lite sold its apparatus expecting the car owner to have service from the ignition system during the life of the car and that when P & D sold parts for replacement purposes it did so without infringement, for the original transaction was with the "implied understanding that the car owner is entitled to repair the same by replacing parts. . . . The defendant is not shown to have done more than sell its parts to proper channels of distribution best adapted to supply them to the car owner. The record discloses no sales to infringers."

Touching upon the question of infringement of the Auto-Lite trade mark, the initials "AL" in a circle, the lower Court found no such infringement, but the higher Court pointed out that the defendant's use of such a trade mark (the P & D mark is the initials "PD" in a circle) began a year before "any use is shown by the plaintiff of a circle around its 'AL' initials. There was no evidence of fraudulent or deceptive conduct by the defendant," and continues that the P & D business has been conducted "to the plaintiff's knowledge in the manner described for more than 10 years."

Describing the method employed by P & D in packaging its products, advertising them and distinctly marking them with the company's own trade mark and code numbers the Court held that none has been deceived by the P & D company. The opinion states: "no car owner or garage mechanic has been deceived or misled by the defendant's use of the phrase 'to fit Auto-Lite' or by its use of plaintiff's code numbers in parantheses after its own code numbers in the defendant's catalogue. There was no evidence of palming off the defendant's goods for those of the plaintiff in the sale of its products."

(*Continued on next page*)

House Committee Reports Eastman Bill Substantially Same as Senate Measure

The Eastman Bill providing for the regulation of interstate motor carriers was reported this week by the House Committee on Foreign and Interstate Commerce in much the same form as the bill passed the Senate. The committee adopted the report of the new subcommittee it named following rejection of the recommendation of the Huddleston subcommittee. In addition, at a press conference, the President reiterated his desire for legislation on this subject.

The revisions made by the House Committee more definitely limit the regulatory powers granted to interstate commerce and exempt vehicles used exclusively in carrying livestock or unprocessed agricultural products and to vehicles used exclusively to distribute newspapers. The authority granted over private carriers was changed to read (new language in italics): "To establish for private carriers of property by motor vehicle, if need therefor is found, reasonable requirements to *promote safety of operation and to that end, prescribe* qualifications and maximum hours of service of employees and *standards* of equipment."

The grandfather clause was changed from Jan. 1, 1935, to June 1, 1935, and the "Dual Operation" section was changed to prohibit such practices after Jan. 1, 1936, unless authorized by the Commission after showing of cause.

The changes made in the bill having to do with intrastate commerce, limit its application to carriers engaged in interstate or foreign commerce, say that nothing in the Declaration of Policy shall be construed to affect state powers of taxation or to authorize a carrier to do an intrastate business, or to interfere with state powers over intrastate commerce. Moreover, the bill is amended so that the Commission would have no power to void intrastate rates which would discriminate against interstate commerce.

As revised the bill would become effective Oct. 1, 1935.

The committee rejected a proposal to set up a separate regulatory division in the ICC for motor carriers.

The less drastic Huddleston proposals have been introduced into the House in the form of a bill to take the place of the Eastman measure and it is possible that Mr. Huddleston may lead a fight for his proposals on the floor.

Representative Monaghan of Montana filed a minority report calling for an 8-hour day for employees of carriers subject to the act. This was at the suggestion of the American Federation of Labor. An amendment to this effect is expected to be proposed when the bill reaches the floor of the House. Motor carriers oppose the 8-hour day as ruinous.

In the matter of the Wollenweber patent the lower Court had dismissed the infringement claim for reason that proof of title was insufficient. The Court of Appeals held that the particular patent "has made no impression upon the particular art. The application was 11 years in the patent office of the assignment," and that "the patent is invalid for want of invention."

Harvester to Expand Springfield Factory

Board Allows $750,000 for New Building and New Plant Equipment

Expansion of the Springfield, O., motor truck works of The International Harvester Co. at an estimated cost of approximately $750,000 has been announced by company officials, following authorization of the expenditure by the board of directors.

The Springfield plant has been operating at near capacity production during the last year, and an anticipated increased demand for the lighter International trucks made expansion imperative.

The principal item in the expansion program is a new sheet metal, paint and enamel building, 165 by 638 feet, with a total floor space of 126,650 sq. ft. The major portion of the building will be one story high. A new power and boiler plant is also to be built.

In addition, a portion of the expansion fund is to be spent for new equipment, moving old equipment, and the rearranging of plant facilities.

Karl O. Schreiber is manager of the Springfield plant, which employs approximately 3,800 persons.

GM Recommends Trackless Trolley System in Flint

A modern transportation system for the city of Flint, Mich., utilizing trackless trolleys and buses and calling for the abandonment of the present street railway system was recommended by the General Motors Truck Company in a report of a survey of Flint's transportation requirements made at the request of city authorities and the Eastern Michigan Railway which operates Flint's present street railway system. The GM report estimated the cost of converting the old system to the new at $727,000, the investment to include five new gas coaches at $23,000, 43 trolley buses at $559,000, new and rebuilt overhead $125,000, and working capital $20,000.

Request Works Allotment For Automotive Surveys

To conduct nation-wide surveys of automotive economic problems, it is reported that the Automotive Division of the Bureau of Foreign and Domestic Commerce, Department of Commerce, has requested an allotment under the Emergency Relief Appropriation Act of approximately $700,000.

The proposed surveys are understood to be divided into three sections: dealer operations, automobile mortality, and export markets.

The dealer operations survey will cover salesmen compensation, used car merchandising and service station operation.

The car mortality survey in some respects will be similar to the actuarial work done by Prof. Griffin, ten years or more ago, but will be much more comprehensive, according to reports, as plans are said to contemplate sampling 3,500,000 cars in 48 states going back to 1915.

The export survey will be made in this country from information available here.

It has been estimated that the various projects will employ about 360 people for a total of 1-1/3 million man-hours, or 673 man-years.

Rail-Highway truck designed by C. C. Nugent of General Transportation Co., Boston. The truck runs onto tracks at any crossing, tires are deflated and wheels locked when flanged wheels settle on tracks. When returning to highway operation tires are inflated by pump attached to engine.

Court Expected to OK 10,000 More W-O Cars

The Federal court at Toledo was expected to grant Willys-Overland receivers today (Saturday) an operating order for 10,000 additional cars, although it may be mid-September before production on the order is underway. However, David R. Wilson, receiver, believes preliminary work can be started within a week or two. The Willys-Overland plant is now completing the last of the previous order for 15,000 cars.

All parties have informally agreed on the operations for the additional cars, but the application and order to show cause why the order should not be granted set today (July 27) as the final date for objections. Creditor interests have indicated that reorganization plans may be completed before any further operating orders become necessary to keep the plant going.

Stewart-Warner Net Profit $1,020,491 for 6 Months

The Stewart-Warner Corp. reports a net profit of $1,020,491 for the first six months of this year which compares with $540,260 net profit for the corresponding period of 1934. For the quarter ended June 30 the corporation reports a net profit of $524,428 against $372,765 for the same three months of last year. The corporation's sales for the January-June period this year amounted to $11,005,560 which compares with $9,240,684 for the first half of 1934.

Fisher Body Purchases Murray Wood Tenn. Plant

Purchase of the Murray Wood Products plant in Memphis, Tenn., is announced by Fisher Body Division of General Motors Corp. The plant, built in 1929, has 360,000 sq. ft. of floor space including 30 lumber kilns, and occupies a 44-acre tract.

"Purchase of this property was made necessary for additional kiln drying, storage and minor manufacturing operations," said E. F. Fisher, general manager of Fisher Body Co. "Beyond this, no considerable expansion of activities in Memphis is contemplated at present. Operations of the present Fisher Body mill in Memphis will not be affected by the acquisition."

Hayes Body Corp.

Hayes Body Corp. reports for the quarter ended June 30 a net loss of $2,936 against a net loss of $49,484 in the preceding quarter and a net profit of $7,846 in the second quarter last year. For the six months ended June 30 the net loss was $52,420 against a net loss of $5,721 in first half of 1934.

General Aircraft Gets Hispano - Suiza Rights

General Aircraft, Ltd., has acquired the British Empire rights for Hispano-Suiza aircraft engines and plans to shortly start producing these engines on an extensive scale in the Douglas motorcycle and aircraft-engine factory at Bristol. This factory was recently acquired by the British Pacific Trust. The entire line of Hispano-Suiza engines, both air-cooled and water-cooled, is to be produced in the English factory.

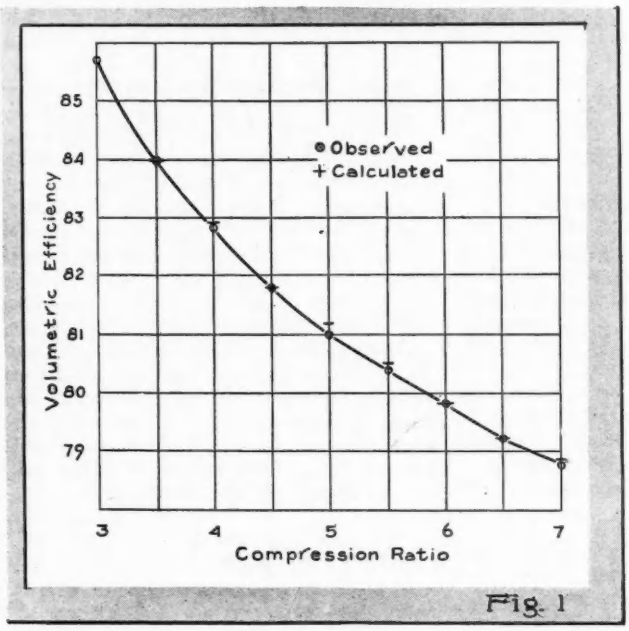
Son Born to Butlers

Mr. and Mrs. A. C. Butler are the parents of a healthy, eight-pound boy, born July 23. Mr. Butler is in charge of the Truck Division of the Automobile Manufacturers Association.

Ford, Chevrolet Receive Big Detroit Car Order

Orders for 174 automobiles for various Detroit city departments were given Tuesday and divided between Ford and Chevrolet. Net cost of the order was $87,502.82.

Influence of Compressio Pressure and Temperatur



Variation of volumetric efficiency with compression ratio

ASIDE from such factors as mechanical design, valve-timing, jacket-temperature, engine-speed, etc., the rate at which fresh charge flows into the cylinder of an engine will depend on the difference in pressure in the intake manifold and in the cylinder. At the beginning of the suction stroke the pressure in the cylinder is very nearly the same as that in the intake manifold, which can be regarded as approximately atmospheric. As the piston moves down, the pressure in the cylinder becomes less than the pressure in the intake manifold, and the fresh charge flows in. The addition of the charge increases the pressure in the cylinder, thereby diminishing the difference between the pressure in the manifold and in the cylinder. There are thus two opposing effects, namely, the downward movement of the piston tending to diminish the pressure, and the addition of fresh charge tending to increase the pressure.

In the following discussion of the effect of compression ratio and barometric pressure on volumetric efficiency, it is necessary to consider only the motion of the piston and the change in pressure produced by the addition of fresh charge to evolve a workable relation between volumetric efficiency and the two independent variables. While the relation derived is theoretical, it leads to results which are well supported by experiment.

The total volume of fresh charge that gets into the cylinder in a given time depends on the rate at which the charge flows in. On account of the downward movement of the piston and the addition of fresh charge, the rate will vary considerably during the suction stroke, going through a maximum at a point less than half way down the stroke. In order to find the total volume of charge that flows into the cylinder in a given time, we have to consider how the original pressure and the total volume of the cylinder affect the rate of flow, and how the rate of flow varies all through the suction stroke.

A strict mathematical treatment would make the volume of charge that flows into the cylinder during any small interval of time a function of the crank angle. Such a treatment would involve following the piston throughout the stroke, and would be very difficult on account of the complex motion of the piston. However, since it is the drop in pressure produced by the downward motion of the piston that causes the charge to flow into the cylinder, the same final result is obtained whether the piston goes all the way to bottom center before the inlet valve opens, or whether the inlet valve is open throughout the entire downward stroke of the piston. By adopting the first procedure it becomes possible to treat the problem mathematically.

In this discussion we have adopted the following artifice. Imagine the piston having traveled adiabatically to the bottom of its stroke without the inlet valve being open. Then the inlet valve is opened instantaneously, and allowed to remain open for a definite length of time while the charge rushes in. The total volume of charge that flows into the cylinder during the given interval of time will then be given by a simple integration.

When the charge is flowing in, the volume, dV, flowing in during the time dt is proportional to the rate of flow at that instant. Or

$$dV = KSdt \qquad (1)$$

in which K is a constant and S is the rate of flow. The approximate relation generally used to express the rate at which a gas flows adiabatically from a point at which the pressure is p_2 to a point at which the pressure is p is

$$S = K_1\sqrt{p_2 - p} \qquad (2)$$

Equation (1) then becomes

$$dV = K_2\sqrt{p_2 - p}\ \ dt \qquad (3)$$

in which p_2 is the pressure in the intake manifold (assumed atmospheric), and p is the pressure in the cylinder at any instant while the gas is flowing in.

In equation (3) V is the dependent variable. In order to be able to integrate the equation it is necessary to express p in terms of V. The desired expression

Ratio, Barometric on Volumetric Efficiency

by Clark C. Minter
and William J. Finn

is readily obtained by adding to the adiabatic pressure produced by the downward motion of the piston, the pressure produced by the addition of fresh charge. Let p_1 be the pressure existing at the end of the downward stroke of the piston without the inlet valve being open; let $V_a = V_c + V_d$ be the total volume of the cylinder, which is the sum of the clearance volume and the displacement; and let V be the volume of fresh charge at pressure p_2 which has flowed into the cylinder, then the value of p is given by the relation.

$$p = p_1 + \frac{V}{V_a}\, p_2 \qquad (4)$$

If (4) is substituted in (3), we obtain the differential equation

$$\frac{dV}{\sqrt{\frac{p_2V_a - p_1V_a - p_2V}{V_a}}} = Kdt \qquad (5)$$

Integrating between the limits O and (V, t) the result is

$$\sqrt{\frac{p_2V_a - p_1V_a - p_2V}{V_a}} = \sqrt{p_2 - p_1} - \frac{p_2Kt}{2V_a} \qquad (6)$$

Solving for V, we obtain

$$V = Kt\sqrt{p_2 - p_1} - \frac{p_2K^2t^2}{4V_a} \qquad (7)$$

For a given engine-speed the time during which the inlet valve is open can be regarded as a constant, so we can write $kt = k_1$, and $k^2t^2 = K_2$, and (7) becomes

$$V = K_1\sqrt{p_2 - p_1} - \frac{p_2K_2}{4V_a} \qquad (8)$$

If the pressure of the residual exhaust gases is taken to be the same as atmospheric in every case, we have

$$p_1 = p_2\left(\frac{1}{r}\right)^{1.4} \qquad (9)$$

in which r is the compression ratio. Further the total volume, V_a, can be replaced by the expression

$$V_a = V_d\left(\frac{r}{r-1}\right) \qquad (10)$$

in which V_d is the displacement volume, and the same under all conditions. The volumetric efficiency is

$$E = \frac{100V}{V_d} \qquad (11)$$

If (9) and (10) are substituted in (8), and the resulting equation substituted in (11) we obtain finally

$$E = K_3\sqrt{p_2\left[1 - \left(\frac{1}{r}\right)^{1.4}\right]} - K_4p_2\left(\frac{r-1}{r}\right) \qquad (12)$$

Equation (12) expresses the dependence of volumetric efficiency on atmospheric pressure and compression ratio. The values of the two constants will vary from engine to engine and depend also on such factors as valve-timing, speed, etc.

If p_2 in equation (12) is constant, we have

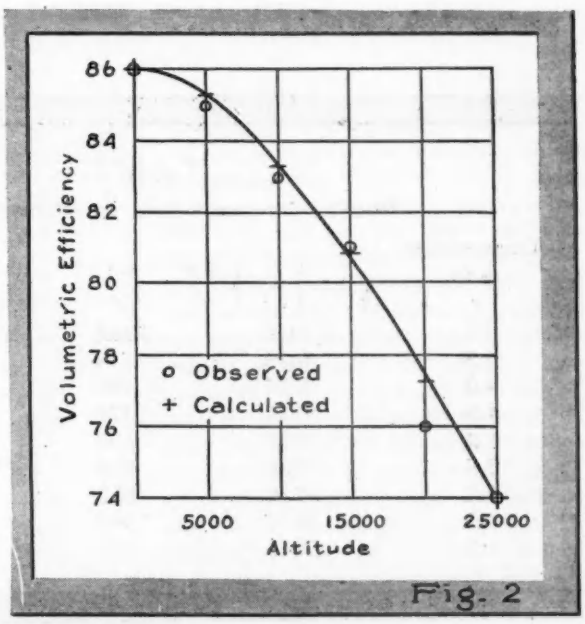
$$E = K_5\sqrt{1 - \left(\frac{1}{r}\right)^{1.4}} - K_6\left(\frac{r-1}{r}\right) \qquad (13)$$

which shows how volumetric efficiency varies with compression ratio.

If r in equation (12) is constant, we find

$$E = K_7\sqrt{p_2} - K_8p_2 \qquad (14)$$

Equation (14) gives volumetric ef-



Effect of altitude on volumetric efficiency (data for observed points by Sparrow and White and N.A.C.A Report No. 120

ficiency in terms of atmospheric pressure; and may be used to determine its variation with altitude.

Ricardo (*The Automobile Engineer*, July, 1921, pages 243 and 245: "Engines of High Output," page 41) has reported his experimental observations that volumetric efficiency decreases as the compression ratio is raised. Sparrow (N.A.C.A. Report No. 205, 1924) concluded that there is no appreciable change in volumetric efficiency as the compression ratio is varied. He did not measure the volumetric efficiencies directly, but reached his conclusions from measurements of compression pressure.

During a quantitative study of engine-knock it became necessary for us to know the full-throttle volumetric efficiency of our engine at several compression ratios. We made experimental determinations and agree with Ricardo in his observations that the volumetric efficiency decreases as the compression ratio is increased.

The apparatus used in our experiments consisted of a single-cylinder, variable-compression C.F.R. test engine, directly connected to a dynamometer. The intake pipe contained an electric heater which made it possible to keep the intake-temperature constant at 100 deg. F. Evaporation cooling kept the jacket-temperature constant at 212 deg. F. Fuel-metering devices were used to measure the time required for a given volume of fuel to flow into the engine. The mixture-ratio was adjusted so as to keep a constant reading on a calibrated electrical air-fuel ratio indicator through which cooled exhaust-gas was passed. This instrument has already been described (Minter, *Jour. Soc. Aut. Eng.*, June, 1925), and depends for its operation on the discovery that the thermal conductivity of exhaust-gas decreases linearly with air-fuel ratio. Since the weight of fuel flowing into the engine in a given time can easily be measured, and the air-fuel ratio is known, it is a simple matter to calculate the weight of air handled by the engine in that interval of time. The volumetric efficiency could then be calculated by means of the equation,

$$E = \frac{V \times S \times R}{W \times \frac{RPM}{2} \times \frac{t}{60}} \qquad (15)$$

Here V is the volume of fuel of specific gravity S that flows into the engine in t seconds; R is the air-fuel ratio, and W is the weight, at 0 deg. C. and 760 mm. of mercury-column pressure, of a volume of air corresponding to the displacement of the piston.

All runs were made with benzene at an air-fuel ratio of 10.85. The engine was run at 600 r.p.m., with the ignition at 12 deg. advance. The graph in Fig. I shows the results obtained after being corrected to 760 mm. pressure. The values of the constants in equation (13) were calculated from the experimental data, and an equation obtained connecting volumetric efficiency and compression ratio.

$$E = 177.4\sqrt{1 - \left(\frac{1}{r}\right)^{1.4}} - 108.2\left(\frac{r-1}{r}\right) \qquad (16)$$

Values of the volumetric efficiency calculated by means of (16) are shown in Fig. I also. It can be seen that the agreement between the experimental and calculated values is very satisfactory.

All the numerical data connected with the calculations are given in Table I.

In the table above are given the numerical values of the two terms in equation (16). It can be seen that both terms increase as the compression ratio is increased. Since the second term increases faster than the first, it is obvious that the volumetric efficiency will decrease as the compression ratio is increased.

Inspection of equation (14) shows that the second term involving the first power of the barometric pressure will change faster with barometric pressure than the first term which contains only the square root of the pressure. This leads to the interesting conclusion that the volumetric efficiency will decrease as the barometric efficiency is decreased.

The diurnal variations in barometric pressure are not of sufficient magnitude to produce an appreciable change in volumetric efficiency. According to the above conclusion $\frac{E_1}{E_2} \neq \frac{p_1}{p_2}$; but the volumetric efficiency increases at a slower rate than the pressure.

The only means of testing the theory

Variation of volumetric efficiency with air temperature

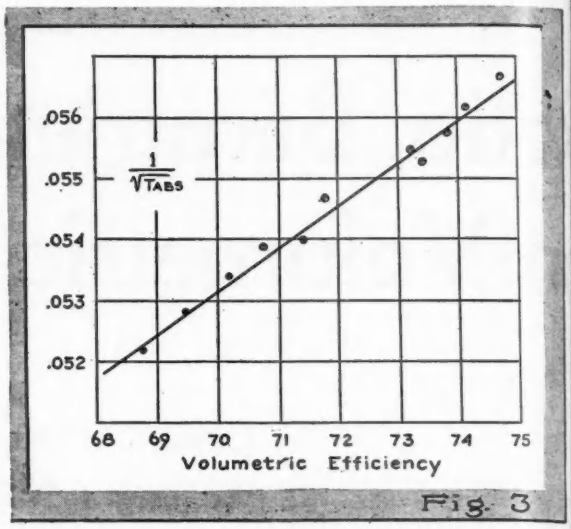


Fig. 3

Table I

Effect of Compression Ratio on Volumetric Efficiency

Compression ratio r	$\sqrt{1-\left(\frac{1}{r}\right)^{1.4}}$	$\frac{r-1}{r}$	Volumetric Efficiency Calculated	Observed
3.0	0.8860	0.666	85.1	85.7
3.5	.9095	.714	84.0	84.0
4.0	.9255	.750	82.9	82.8
4.5	.9370	.778	81.8	81.8
5.0	.9458	.800	81.2	81.0
5.5	.9530	.818	80.5	80.4
6.0	.9585	.833	79.8	79.8
6.5	.9630	.847	79.2	79.2
7.0	.9675	.857	78.8	78.7

experimentally is to measure the variation of the volumetric efficiency of an engine with altitude; for under such conditions the variations in pressure would be of sufficient magnitude to produce definitely measurable changes in volumetric efficiency.

Fortunately the necessary data are available from tests made at the altitude chamber of the Bureau of Standards. Sparrow & White (N.A.C.A. Report No. 102 1920) give results which show that the volumetric efficiency of a Liberty 12 aviation engine, compression ratio 5.4, decreases as the barometric pressure is decreased.

Sparrow & White measured the volumetric efficiency by means of a venturimeter. Their figures for 1600 r.p.m. are plotted in Fig 2 and given in Table II. Since the numerical value of the constants in equation (14) can be evaluated from the experimental data, it is possible to calculate the volumetric efficiency at different altitudes by means of the equation

$$E = 19.6\sqrt{p_2} - 1.114p_2 \qquad (17)$$

Values obtained by means of equation (17) are also given in Fig. 2 and Table II. The agreement is regarded as satisfactory.

Sparrow & White give also some data regarding the volumetric efficiency of a Hispano-Suiza 300 hp. airplane engine. The volumetric efficiency appears to vary irregularly with altitude, but the tendency to diminish with increasing altitude is apparent.

These experiments were made on a single-cylinder engine of the L-head type, having a compression ratio of 6. The engine was run full load at 600 r.p.m. on pure benzene with the mixture-ratio adjusted in every case to 10.85. The temperature of the air was varied by means of an electric heater in a pipe connected to the inlet of the carburetor. The short induction pipe (about 4 in.) connecting the carburetor with the cylinder block was not heated, and all variations in volumetric efficiency were produced simply by heating the air before it entered the carburetor. The temperature of the air was measured by means of a mercury thermometer situated in the inlet of the carburetor. The volumetric efficiency was measured by the method already described in connection with the variation of volumetric efficiency with compression ratio.

The experimental results are given in Table III. It is clear that the volumetric efficiency is not proportional to the density of the air at the carburetor. Instead of being inversely proportional to the absolute temperature, the results show that the volumetric efficiency is inversely proportional to the square root of the absolute temperature. This fact is evident in Fig. 3, where the volumetric efficiency is plotted against the reciprocal of the square root of the absolute temperature and a straight line is obtained.

These observations can be explained by means of a well-known relation governing the flow of air. This equation states that the weight of air flowing through an orifice in unit time is inversely proportional to the square root of the absolute temperature. Or,

$$W_1 = \sqrt{\frac{K_1}{T_1}} \qquad (18)$$

Since volumetric efficiency is defined by the relation

$$E_1 = \frac{W_1}{W_o},$$

where W_o is the weight of air for a full cylinder charge at 0 deg. C., 760 mm., we find, finally that

$$E_1 = \sqrt{\frac{K}{T_1}} \qquad (19)$$

represents the variation of volumetric efficiency with inlet temperature.

Qualitatively these results are in agreement with those of Gibson (Advisory Committee for Aeronautics, E.S.C. Report No. 35, 1918) and also those of Gage (N.A.C.A. Report No. 108, 1920). These investigators find that as the inlet temperature is raised, the volumetric efficiency does not diminish as rapidly as the density. The magnitude of the variations found is not so great as we have observed It must be pointed out, however, that our measurements were made at low speed on a single-cylinder engine having a very short intake pipe; while the investigations of Gibson and those of Gage were conducted on multi-cylinder engines.

Table III

Effect of Inlet-Temperature on Volumetric Efficiency

Temp. of inlet air		Volumetric efficiency	
Deg. C.	Abs.	0 deg. C., 760 mm.	$\frac{1}{\sqrt{T}}$
38	311	74.7	.0567
85	358	69.5	.0528
67	340	71.4	.0540
51	324	73.2	.0555
38	311	74.7	.0567
48	321	73.8	.0558
61	334	71.8	.0547
71	344	70.8	.0539
77	350	70.2	.0534
54	327	73.4	.0553
43	316	74.1	.0562
95	368	68.8	.0522

Table II

Effect of Altitude on Volumetric Efficiency

Data by Sparrow & White—N.A.C.A. Report No. 102, 1920

Altitude (feet)	$\sqrt{p_2}$ Cms of Hg	$\sqrt{p_2}$	Volumetric Efficiency Observed	Calculated
Ground	74.5	8.63	86	86.0
5,000	63.6	7.97	85	85.4
10,000	52.9	7.27	83	83.3
15,000	43.5	6.60	81	80.9
20,000	36.1	6 00	76	77.4
25,000	30.1	5.48	74	74.0

More Than a Million Jobs Provided by New Industries

THE importance of new industries which are being constantly created by advances in science, invention and technology as sources of new employment opportunities for labor is strikingly revealed in a recent report of the National Industrial Conference Board. As shown in Table 1, 18 new industries alone which did not exist in 1879 absorbed almost one-seventh of all labor employed in manufacturing activity in 1929.

Of the eighteen industries developed since 1879 the automobile industry occupies first place as employer of labor. In 1929 this industry gave employment to about 450,000 workers, one-half of whom were engaged in the manufacture of vehicles and the other half in producing motorcycles, automobile bodies, and parts. The electrical machinery industry occupies the second place, with an employment of 328,000 workers in 1929. The manufacture of fountain pens is in the last place, with an employment of only 4500 workers in 1929.

The importance of these new industries as employers of labor in relation to all manufacturing activities is displayed in Table 2.

Total manufacturing in 1879 employed about 49,000 wage-earners for every 1,000,000 inhabitants in the United States. In 1929, after a half century had elapsed and the population had grown to two and one-half times its 1879 size, the manufacturers employed almost 73,000 wage-earners per million of population, an increase of 24,000 workers per million of population, or close to 50 per cent in per capita over the 1879 ratio. No less than two-fifths of this increase in per capita employment has been brought about by these new industries. They accounted for 9200 wage-earners per million of inhabitants in the country in 1929.

In 1929, 18 new industries gave employment to 1,123,314 workers. This figure, however, does not measure the total contribution of science, invention, and technology to increased employment. It covers only the field of manufacturing and only some of the most important industries in their field. It does not indicate the number of new jobs created in such important fields of activity as public utilities, various transportation and distribution industries required for the marketing of goods and services produced by the newly established manufacturing industries. Nor does it give credit to the increases in the volume of employment affected in the established industries supplying raw materials or basic manufactured commodities utilized in the creation of these new products. To mention a few, mining activities required four times the number of workers in 1930 as in 1880; the iron and steel industry increased the number of its wage-earners by more than 500 per cent during the same period, and the industry engaged in the manufacture of glass similarly employed nearly six times as many workers at the end of the period as at the beginning.

Even on this limited basis, however, Table 2 shows that 18 new industries accounted for 18 per cent of the total increase in employment in the field of manufacturing and that they accounted for 40 per cent of the increase in employment in relation to the growth of the total population.

Table I

Partial List of New Manufacturing Industries

Industry	Average No. Wage-Earners—1929
Electrical machinery, apparatus and supplies	328,722
Motor vehicles (not including motorcycles)	226,116
Motor vehicles, bodies and parts	221,332
Rubber tires and inner tubes	83,263
Manufacture of gasoline [1]	39,411
Rayon and allied products	39,106
Manufactured ice	32,184
Aluminum manufactures	21,210
Typewriters and parts	16,945
Refrigerators, mechanical	16,883
Cash registers and adding and computing machines	16,840
Oil, cake and meal, cottonseed	15,825
Aircraft and parts	14,710
Phonographs	14,416
Photographic apparatus and materials	12,967
Motion picture apparatus (except for projection in theatre)	10,784
Asbestos products [2]	8,092
Fountain pens [1]	4,508
Total, 18 new industries	1,123,314
Total, all manufacturing industries	838,743

[1] Estimated.
[2] Excluding steam packing and pipe and boiler covering.

Table II

Labor Absorption by Selected New Industries Since 1879

	Total in Millions	Per million of Population
Wage-earners in Factories in 1879 [1]	2,430	49,437
Wage-earners in Factories in 1929 [1]	8,840	72,731
Difference of 1929 over 1879	6,410	23,294
Wage-earners in 18 New Industries in 1929	1,123	9,234
Percentage of increase in employment due to new industries	18%	40%

[1] Correction for wage-earners in hand and neighborhood industries estimated.

Note: Employment in 18 new manufacturing industries related to the total employment in manufacturing activity.

Just Among Ourselves

Truck Taxes Pay Road Maintenance Costs

MAINTENANCE of state highways in 1932 cost $169,479,399, while interest on state highway bonds and notes amounted to $69,292,199, a total of $238,771,598. In the same year the National Highway Users Conference points out that trucks and buses paid $215,909,686, according to estimates of the Bureau of Public Roads. This sum was obviously sufficient to cover all maintenance costs and in addition most of the interest on highway indebtedness — indicating that commercial vehicles do pay their way.

* * *

Still Going Strong at 55

NOT everyone can work in Department 103 in the Dodge main plant. To get a job there, you must be 55 years old at least and must have been employed by the company for at least 10 years. Some exceptions are made to these qualifications where workers are handicapped permanently or temporarily for the work they have been doing. In the case of the temporarily handicapped, they go back to their regular work as soon as they are able.

We heard about this department a good many months ago, but we just ran across a rather old copy of the Chrysler Motors Magazine which gives this description of the work done in the department:

"Here are performed operations that require patience, care, and deft hands rather than brawn and speed—small machine work, light assembly, bench work, and so forth. Men who have given their best years to their work are placed in this department where they have the opportunity to really earn a living at jobs they can do as well as younger men."

Life doesn't end at 40 in the automobile plants, as the Henderson report charged, nor does it end at 55, as this Chrysler activity indicates.

* * *

Rationalizing the Dealer Set-Up

RATIONALIZATION of the industry's dealer set-up seems likely to be one of the major automotive trends in the next 12 months. General Motors has already revealed that it is studying its car dealer organization from this standpoint and indicated that the objective is to achieve a better balance between representation and potential as rapidly as possible with due consideration to all the equities in the situation. We also learn that another leading car maker already is taking steps to the same end in areas where volume doesn't justify the existing setup.

* * *

Factories to OK Guide Book

IT now appears probable that the car makers rather generally will endorse the guide book of used car values published by the National Automobile Dealers Association, which will give the book a sort of official status in the industry. In return for their endorsement, it is understood that the factories are to have some say about the values shown in the book. Also it is reported that the factories will insist that the book be sold separately and not as a part of an N.A.D.A. membership.

* * *

A Word to Describe Anti-Knock Value

OUR suggestion that some new single word to describe the anti-knock value of fuel so far has drawn five responses.

M. R. Vogel, of Easton, Pa., suggests that good anti-knock fuels be called "soft," the bad knockers "hard," and that those in between might be called "mellow."

Dayton Young, vice-president of the Ludwick Corp., Detroit, proposes that "quieted" fuels would describe those high in anti-knock and that quieter and quietest could be used in comparisons.

Willys-Overland sales manager R. J. Archer suggests "knockless."

"Soft" also is suggested by Arthur A. Kopf of Ancon, C. Z., who points out that it "is very simple and suggests the action of the fuel as not being harsh and causing annoying pinging or knocking in the combustion chambers. . . ."

From Robert Hofstetter of Jackson, Mich., comes the suggestion "nockmild," "nockmilder" and "nockmildest;" also "burnsmooth," "burnsmoother" and "burnsmoothest."

We'll be glad to receive more suggestions.

* * *

For what the information is worth, we were told the other day that more than 50 per cent of the new drivers' licenses issued in Pennsylvania, go to adolescent girls.

—D. B.

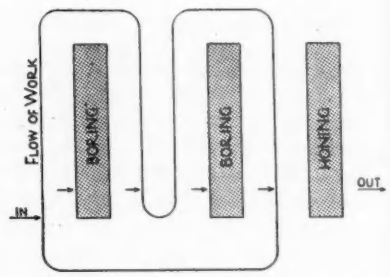
Ford Adopts Single Point

Air-conditioning system maintains standard temperatures in department where cylinder barrels are machined and honed to close limits at low cost

ANOTHER important advance in precision engine building has been scored by the Ford organization. In recent years it has been recognized that good engine performance as well as the life of the piston assembly and cylinder walls depends to a large degree upon the compatibility of cylinder wall and piston ring materials; also upon the quality of cylinder wall finish. The latter depends not only upon finish but upon the related elements of true roundness, perfect straightness of cylinder bores, correct alignment of bores, and close manufacturing tolerances.

Ford has centered the production of perfect cylinder bores about the development of an eight-spindle, high-speed precision boring machine using single-point cutting tools tipped with a suitable grade of cemented carbide. Twelve of these machines have been installed, this battery being sufficient to take care of current production.

Recognizing the difficulty of maintaining close manufacturing tolerances under the usual factory conditions, Ford has worked out a compact, self-contained department housing the battery of boring machines and the necessary honing machines. This department is completely enclosed and sealed and maintained at standard atmospheric conditions by means of an air-conditioning system. Air temperature in the enclosure is held at 72 to 73 deg. F.



Sketch showing general floor plan in air-conditioned cylinder boring department.

Gaging cylinder bores as the blocks leave the boring machine. This view shows more detail of the machine in C. Note the two clamping heads in the center as well as the motor driven spindles.

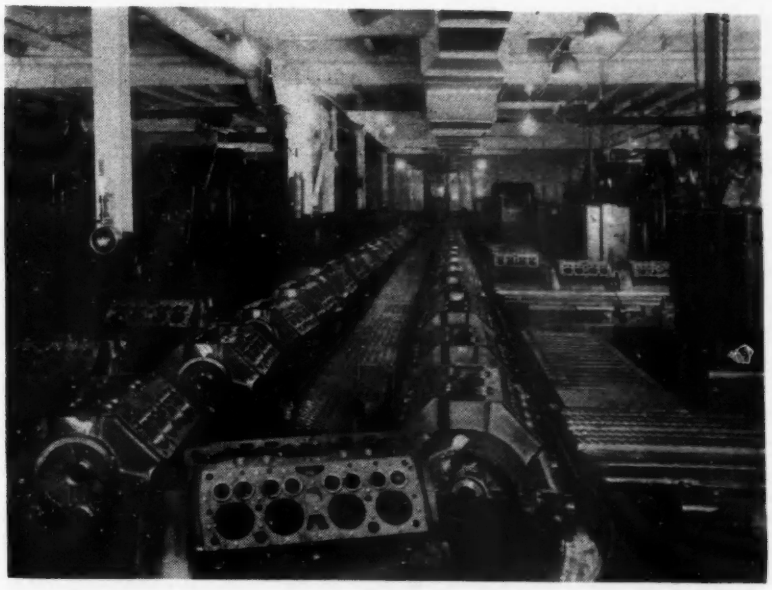
By means of this control, the work, tooling, gages, and production equipment all are maintained at the same temperature, thus eliminating one of the most troublesome variables encountered in machine shop practice. Practical shop men may well ask how the temperature control can be made sensitive enough to keep machine elements at the same level as that of the surroundings. This is done in two ways: In the case of the boring machines, the entire hydraulic system is self-contained in a cabinet set within the machine and insulated from the mechanism by a generous air space. Actually, the elements of these big machines have no hot spots anywhere.

In the case of the honing machines, the kerosene which serves as the coolant is stored outside of the enclosure, where it is held to a temperature of 70 deg. F. and is circulated to the machines, thus holding the temperature of the liquid within reasonable limits.

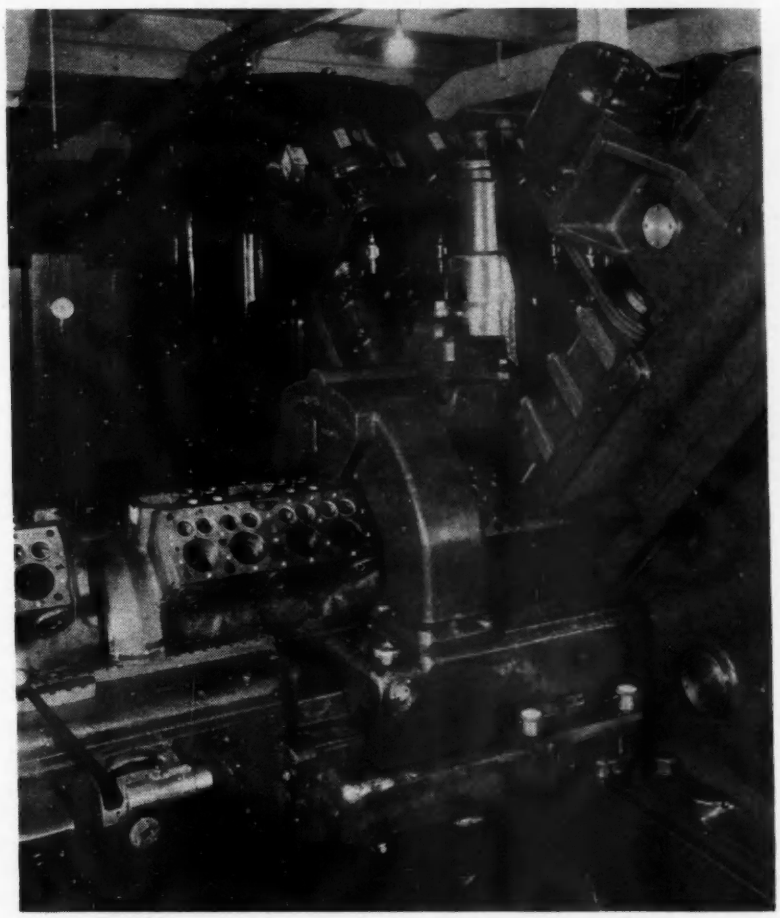
Under these controlled conditions the cylinder bores are finished to precise limits. Alignment of bores as to centers and perpendicularity with respect to crankshaft bearings is held within 0.001 in. Diameter of bores, roundness, and straightness, all are held within a total limit of 0.0002 in. with a maxi-

Boring

by Joseph Geschelin
Detroit Technical Editor,
Automotive Industries



Looking down the conveyor between the two lines of boring machines. Cooling system ducts overhead.



Close-up of one of the battery of eight-spindle, single point boring machines. This view plainly shows several of the high-speed precision boring heads; also one of the two vertical clamping attachments. The hand lever controlling the movement of blocks for indexing and clamping is seen in the foreground at the left.

mum variation in a small proportion of bores of 0.0003 in.

The single-point, cemented-carbide tools are showing remarkable performance. They are good for at least 500 bores per grind—operating at a speed of 520 rpm. and feed of 0.007 in. per revolution of the spindle.

As will be explained later, each boring machine finishes two blocks per cycle, with an output of 28 blocks per hour per machine. Each machine has an inspection station and each bore is inspected 100 per cent by means of a three-point cylinder gage.

Before proceeding to a detailed description of the layout and equipment in this department, let us note some of the remarkable economies that have been accomplished with this set-up. In the first place, a number of orthodox steps have been entirely eliminated. Thus the blocks are only rough and semi-bored when they reach the finish-boring machines. The job is done so perfectly that honing is a relatively simple operation.

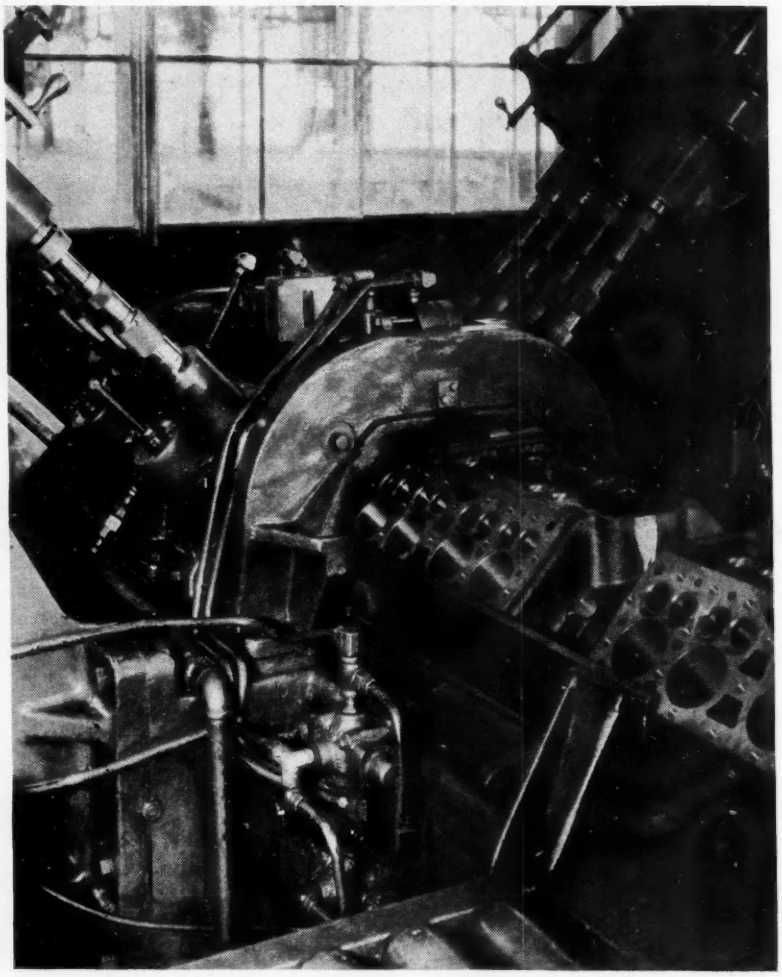
Thus, Ford uses single honing only, and even this step has been reduced to the point where only six passes of the hone are required.

The general layout of the cylinder boring department is shown in the floor plan. There are three lines of machines—two lines of boring machines, six to the line, and a battery of four honing machines at the extreme right. The three lines are threaded by a single machine-level conveyor which loops around in U-form as shown.

Semi-bored blocks are washed in kerosene and rinsed in cold water which holds the work to about 70 deg. F. The spray is blown off and the blocks are immediately transferred onto the conveyor through a window at point A. Rough and finished blocks move together on the conveyor, some of the rough blocks being picked off at the left or entering side of the boring machines, the others traveling down to feed the second battery.

Finished blocks come out of the machines at the right and travel around from both batteries to feed the honing line at the extreme right.

At the tip of the U in the foreground is a master fixture which is used for checking the setting of each boring ma-



One of the battery of eight-spindle fully automatic honing machines. Only six passes of the hone, in one setting, are required to finish the bore.

chine after tool changes, changeover, or wherever changes in setting may be necessary.

Each of the boring machines has eight high-speed precision boring heads with individual motor drive. All feed movements, chucking, etc., are operated hydraulically and the entire cycle of events is controlled electrically and protected by a system of electric interlocks.

Each machine handles two blocks at a time, producing 28 finished units per hour. Because of the precision demanded on the boring operation, the boring heads are of generous proportions and well supported close to the beginning of the cut. Because of this the heads are so spaced as to take alternate holes. In the cycle of events, therefore, all eight heads bore one set of holes, the tools retract, the blocks are indexed forward automatically, a distance of 4 in., and then the second set of eight bores is completed.

One of the interesting features of the cycle is the provision for clearing the tool tips when the heads complete the stroke. In the first place, all the heads are synchronized so that the fly cutters on every head are in the same relative position. To assure this alignment each head is fitted with dogs which seat automatically as the heads complete their stroke. No spindle can retract from the bore until the dog has lined up the cutting tip, and the entire mechanism is momentarily delayed until all spindles are lined up.

Simultaneously, the indexing table mechanism shifts the table laterally 1/64 in. to clear the fly cutters. Then the spindles move out of the bores without scraping, thus protecting the finish and prolonging the life of the tool.

Clamping and loading of machines is a semi-automatic process controlled by the operator. He loads the blocks on the table, the blocks are moved in automatically, but to clamp in place the operator moves a lever actuating an hydraulic mechanism which pushes two locating plugs in place on each block and simultaneously clamps by means of two overhead rams which apply an equalized pressure over the head of each block.

Honing machines as shown are of the latest type, each one having eight reciprocating spindles. This entire set-up, including refinements in the hones and stones, serves as a fine lapping operation. Only six passes of the hone are required to produce the desired results.

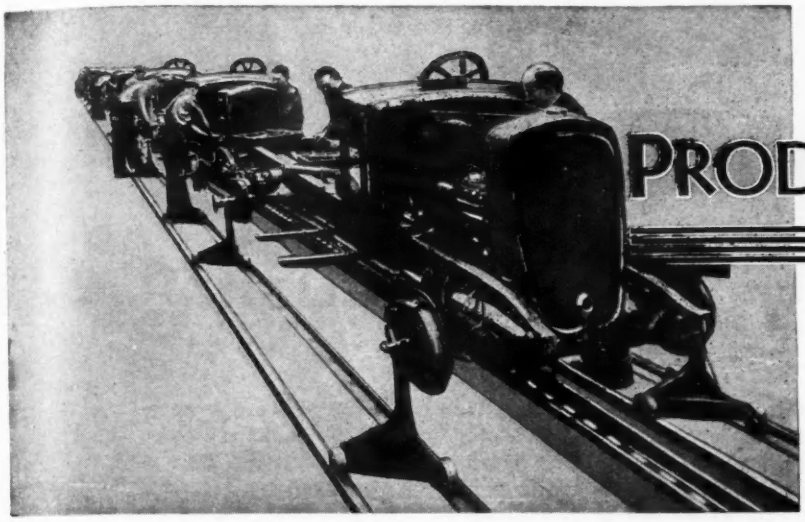
This development undoubtedly is of more than passing interest to all those concerned with engine manufacturing.

Contest to Promote Fuels Other Than Gasoline

A NATIONAL fuels contest is being held at present between Rome and Paris, the start having been made at Rome on June 21 and the contest being scheduled to end at Paris on July 17. The object of the contest, which is sponsored by the national automobile clubs of France, Italy, Belgium and Luxemburg, is said to be to demonstrate that national fuels other than petroleum spirit offer the same advantages, and others to boot, as the conventional gasoline; that numerous fuels are available, solid, liquid and gaseous, about which too little is known to the motoring public, and that they may be used in vehicles of all types, light as well as heavy. All vehicles starting in the contest will be checked at Rome. At Milan there will be a special exposition of Italian electric vehicles, and at Lyons a similar exposition of French electric vehicles. Speed and fuel economy tests will be made on the race tracks of Monza and Le Mans, and the runs from Rome to Florence and from Le Mans to Paris will be checked.

Wrist Pin Lock Screws Used in LaSalle Balancing

IN balancing the weights of reciprocating parts of the La Salle engine, the connecting rods are weighed at both ends and the weight at each end is brought to within 1/32 oz. of a set figure by removing metal from a forged-on boss. The piston is weighed and its exact weight is marked on. Piston and connecting rod are then joined by the wrist pin which is secured in the piston by means of a lock screw. This lock screw is made use of to further reduce the differences between the weights of individual sets of reciprocating parts. Thirteen different lock screws are provided, the difference being in the head thickness, each of the screws weighing 1/46 oz. more than the one preceding it in the series. These screws are selected in accordance with the weights of the pistons. It is claimed that by this method the tolerance on the weight of reciprocating masses is held to within 1/64 oz.



PRODUCTION LINES

Climb Milling

There's a job in limited production in which the work is rough-turned by milling. Two milling cutters are used, diametrically opposed, cutting by climb cut. In this set-up, the work is carried right on the cutters and needs no centers. Announcement of a special application of this principle should be forthcoming soon.

Handles IT

A cross-sectional view of materials handling in a variety of industries is found in a new bulletin just issued by the Chain Belt Company. It's chiefly illustrative, easy to follow, and full of practical value to plant engineers and factory executives. Ask us for your copy of "How to Handle IT."

Plain Bearings

We are very much impressed with the fact that there is a definite place for plain or sleeve bearings in the design of automotive equipment. There is a place, of course, for all types of plain and anti-friction bearings, but the point is that the spot for each one must be carefully picked. You would be interested in the criteria set up by one important organization for the selection of plain bearing applications.

All-Metal

July *Flashes*, by Thomson-Gibb, gives an interesting outline of the role of resistance welding in the production of the metal radio tube. By the way, have you investigated the metal tube? It's much smaller—takes less space; stronger; better shielded; easier to attach to the molded base.

Electroplating

A wide variety of electroplating equipment—fully automatic, semi-automatic, variable speed, etc.—is profusely illustrated in a bulletin recently issued by the U. S. Galvanizing & Plating Equipment Corp. The material is so arranged as to show not only the equipment but the process as well. For this reason alone it should be of practical value to the plant engineer.

Cooling

One of the best informed men in the cooling system field tells us that great advances have been made recently in radiator core design. It would pay designing engineers to talk it over with him, what with narrower radiator shells in the offing. He tells us, too, that he has developed a complete air-conditioning system for buses. Some bus builder will cash in on this.

Like Accordion

There is a new brake on the market with novel features. Essentially it consists of four segmental shoes which move outwardly from the center. Each shoe is attached to an accordion-shaped metal bellows which expands as hydraulic pressure is applied. No cams, no equalization problem, equal pressure and contact all around. It has been used successfully by large fleet operators in Canada.

Two Years

One of the leading tire makers has been showing some of their friends what the tire of the future will be. The feature of this particular line is complete elimination of road noise, at least consistent with the type of road surface.

Body Hinges

Body engineers and purchasing agents will be interested in a new bulletin by Soss, just off the press. It covers the complete line of Soss body hinges, including several forms of concealed hinges. An interesting feature of the presentation is the use of blueprints giving the actual details and dimensions of each part. Copies are available for our readers.

By Reeds

An amazing development in carburetion is being shown to certain engineers by one of the well-known carburetor makers. Its chief departure from the orthodox is a means of automatically introducing additional air at high speeds and heavy loads. This is done ingeniously by uncovering slots in the main venturi by flexing a set of four reeds. More of this when the time is ripe.

Broaching

The shock-absorber ring wing, one of the most difficult production jobs in metal cutting has been thoroughly licked by at least one large producer. Right now most of the roughing and finishing operations are being handled by new vertical surface broaching machines. Within a couple of weeks they expect several more machines. When these are installed, practically every step in the process will occur automatically on this battery of surface broachers.

—J. G.

MANUFACTURING MANAGEMENT METALLURGY

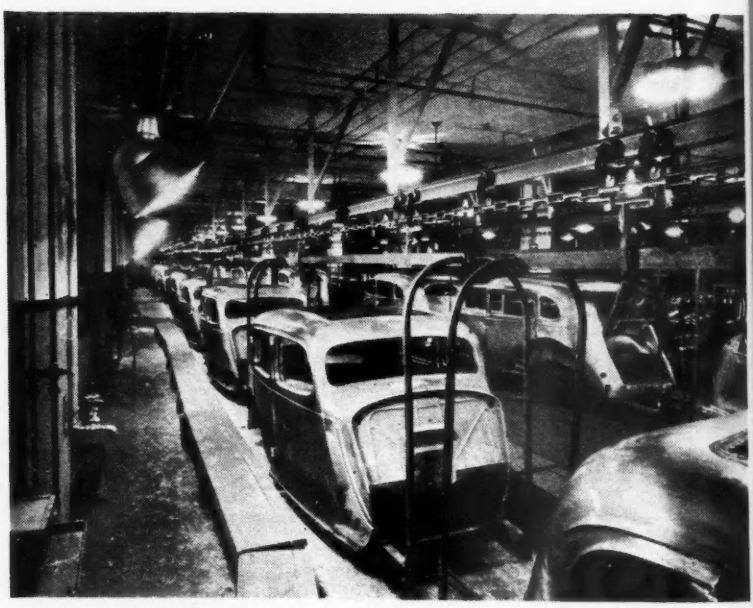
High Intensit
Increasing Us

WHILE machine-tool makers and production men in automotive plants have been busy devising means for speeding production during recent months, specialists in lighting have been making equal gains in improving their equipment for industrial illumination. Production conditions in several important automobile factories have already benefited from this improved lighting, and similar benefits are contemplated in the plants of parts and accessory manufacturers who are watching these new lighting installations with great interest.

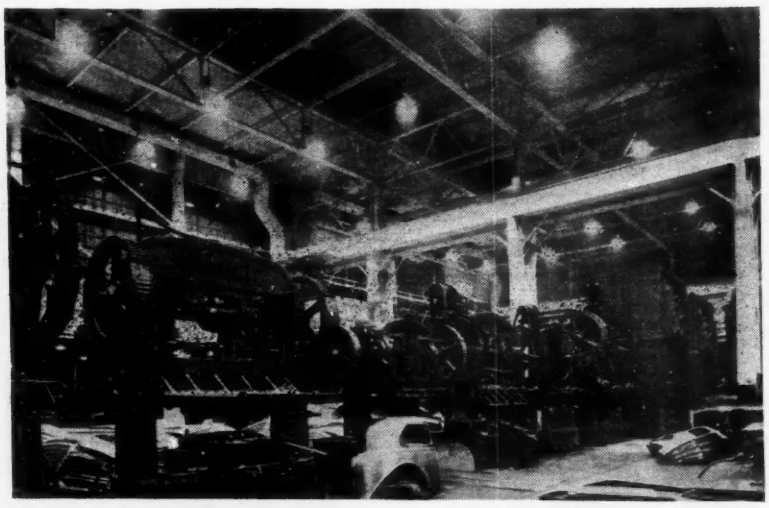
Outstanding among these new lighting installations are several which make use of a new form of mercury-vapor lamp, the high-intensity lamp recently developed by the General Electric Vapor Lamp Company. To secure first-hand information about these installations, and the results which have been secured, the writer recently visited nearly a dozen plants (chiefly automotive) in which the new form of lighting is being employed.

High-intensity lights are giving excellent satisfaction on the body assembly line on which the new Packard car bodies are built. They are also in use for practically all body operations in one of the newest and finest body assembly plants in the East, as well as in an adjacent chassis assembly plant, which together have more than 1500 of these modern lamps in service.

Angle-type reflectors are used chiefly in body assembly because the principal surfaces to be viewed are vertical and light must also shine through door and window openings to illuminate the interior of the body. Angle-type lamps also need to be low hung for the same reason. With the new form of light hung in angle reflectors about 7½ to 8 ft. above the floor and spaced on about 10-ft. centers, excellent illumination of work surfaces is secured. Each light consumes about 440 watts and provides an average of about 50 ft. candles on body sides, nearly 100 ft. candles on the roof deck, and perhaps



Typical installation of General Electric High-Intensity Mercury Vapor Lamps in a new high bay at a Briggs body stamping plant in Detroit. The lamps are 42 ft. above the floor, are spaced on 16 x 18 ft. centers and give over 20 ft.-candles at the working levels. Even at the bottom of open pits, more than 50 ft. below the lights, there are no dark shadows and seeing is excellent



Body production lines at the Packard plant. Angle-type reflectors are used along the windows and horizontal reflectors between rows of bodies. Even inside the bodies there is plenty of light. The new General Electric High-Intensity Mercury Vapor Lights are employed

20 ft. candles on interior surfaces. The illumination is much superior to that given by 300-watt incandescent lamps on 6 ft. centers (about twice as close together as for the mercury vapor type) according to individuals who have supervised work under both types of lighting.

Besides consuming less energy, the operator discomfort from radiant heat

Mercury Lamps Finding In Automotive Plants

is materially reduced with the vapor lamp. Another notable feature is the reduction of glare. Shadows are also lighter and every scratch and file mark on the body is clearly seen. There is plentiful light to see clearly for interior work, such as trimming and applying other parts. Ground-glass covers on the angle reflectors further improve diffusion and help to keep the reflectors clean. In spray booths, or under spray hoods where no booth is used, angle reflectors may be hung still lower and closer spacing may be used if more light is desired. No portable inspection or other drop lights are needed at any point on the lines.

Close-up of body assembled at the Packard plant. The freedom from dark shadows and good illumination within the body are brought about by using the new General Electric High-Intensity Vapor Lamps. Scratches and other defects on body exteriors are also easily seen without using portable drop lights

An early and very high-bay installation has now been in night and day operation at one of the Briggs body plants in Detroit for for several months. This bay is nearly filled with huge presses for body panels, and lights have to be placed 42 ft. above the floor to clear the cranes. The floor is honeycombed with pits for press foundations and piping. Shadows cast by the crane must also be overcome to provide ample light for seeing below it. 136 high-intensity lamps placed on 16 x 18-ft. centers provide excellent light at night and are often burned during the day as well. Each lamp is provided with a deep bevel reflector and each has its own transformer nearby and operating off 115-volt circuits.

Another body plant, located in Cleveland, has two similar bays with very large presses similarly lighted, but in this instance each bay has three rows of high-intensity lamps (440-watt mercury vapor) and between these rows are 750-watt Mazda lamps. There are thus two outer and one center row of high-intensity lamps and between each outer row and the center row a staggered row of the Mazda type. Lamps are placed on about 15-ft. centers, and there are a total of 87 high-intensity and 58 Mazda. This mixed light gives a close approximation to daylight at the working level as to color. No color judgment is necessary in this part of the shop, however, and the real reason for the combination installation appears to have been as a safeguard against current interruptions since, if the high-intensity mercury lights go out through any interruption in current supply or a drop of over 20 in voltage, they do not re-light until they cool for about 15 minutes. Outage so seldom occurs in large-city installations, however, that most plants do not consider it necessary to provide against it. It is significant that, although the 58 incandescent lamps in this installation consume more current than the 87 mercury-vapor lamps, they give out only about half as much light.

Besides the installations named, several smaller ones in both large and small shops were found to be providing results unobtainable with former lighting methods. In one instance, four lamps have been hung on the under side of a crane and thus provide extra illumination under the crane constantly as it moves back and forth. As the new lamp has no filament, it is not adversely affected by such vibration as occurs in an application of this nature.

As to visual characteristics of the light itself, the new high-intensity light is somewhat similar to the long-tube or "low-intensity" mercury-vapor light so extensively used for many years in many large automotive and other factories where good seeing conditions are important. The new unit is much more compact, however, and is made with a screw base to fit an ordinary Mogul socket. The bulb is only 13 in. long overall and is made for use in a vertical pendant position the same as high-wattage incandescent lights, employing the same or a very similar reflector. The total light output per inch of tube length is nearly three times that of the 50-in. Cooper-Hewitt tubes, because the gas is made to glow more brilliantly or with higher

intensity—hence the name "high-intensity" lamp. The amount of light made available at the working zone naturally varies as in other lights, with the area covered or with the spacing of the lamps. It happens that most of the installations made to date give a very high level of illumination in the working zone, but this is not the reason for referring to the light as a "high-intensity" unit, as the light distribution can be varied, of course, by varying the spacing of the lamps. Aside from socket and reflector, the only equipment required with the new lamp is a small reactor for 230-volt circuits or in the case of 120-volt lines, a small transformer.

Because of its higher brilliance, the high-intensity light gives the appearance of being "whiter" than the commoner form of mercury vapor light. Actually, the color is a balanced combination of yellow-green and blue. Red rays are absent, as with other mercury-vapor lights. From the standpoint of eye fatigue, the absence of these rays actually improves the light, but, of course, it does not give "true" color values when red objects are viewed. This effect on color does not, however, detract from the value of the light for industrial use except in the rare cases in which red must be distinguished as such. In many instances variations in the shade of colors are more readily distinguished in the mercury-vapor light than in either daylight or incandescent light.

AUTOMOTIVE ABSTRACTS

Hints on Wind-Tunnel Testing of Small Scale Car Models

AUTOMOBILE engineers repeatedly have expressed their lack of faith in the results of wind-tunnel tests on small scale models. One reason for the unreliability of such tests is that they are often made on simplified models merely representing the basic form, without seams and joints and with a superlative finish. The effects of a bumper projecting far in front of the car, of a sharp-edged number plate, wide-open radiator air entrance, filler neck with nameplate, and headlamps, all of which tend to create a turbulent flow, are disregarded, and the advantage of a well-thought-out front end form is often completely lost. Under favorable circumstances the car may have an attractive appearance, and an air-resistance coefficient of 0.60 (metric units) instead of the hoped-for 0.40. The excess of 50 per cent in the air-resistance coefficient is conveniently ascribed to the impossibility of accurately transferring the test results from the small scale model to full size.

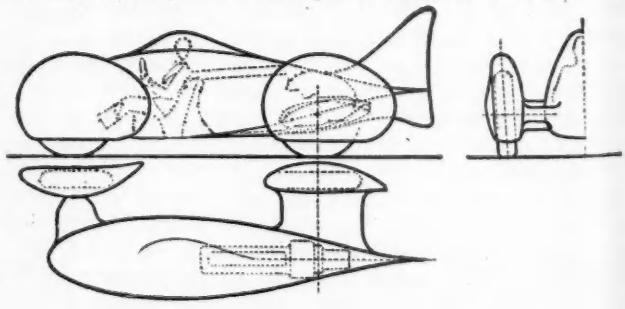
To solve the problems presented with a degree of accuracy which warrants the efforts required, the Reynolds number in the tests should be as high as possible. This means that the model should be relatively large and the air velocity in the tunnel high. Two forms of streamlined bodies were subjected to tests in two different wind tunnels. The two bodies were of rather similar form, but the air resistance coefficients found by one of the tunnels were widely different, while those found by the other tunnel were nearly alike. The reason was that the first tunnel operated at Reynolds numbers up to 500,000 only, while the other extended its tests up to a Reynolds number of about 1,600,000, which carried the experiments into the region of turbulent flow. For automobiles the scale models should be of one-fifth to four-tenths actual size. This, of course, requires a large tunnel. The Zeppelin air tunnel has a throat diameter of 3 meters (nearly 10 ft.) and the maximum air velocity is 170 ft. per sec. (115 m.p.h.).

If the wind tunnel test on a car model is to be not merely a rough approximation but suggestive to the designer, the following requirements must be met: The model should preferably be to a scale of 1: 2.5. It should be made hollow and in as many sections as conveniently possible, so that individual parts can be replaced at will, and the difficult problems of air flow studied. All essential fittings must be in place. The wheels should be rotated by electric motors built into the model, and the influence of the proximity of the road surface must be simulated by providing a moving track.

The experiments then divide into three groups of tests, as follows: First, pressure (resistance) measurements by weighing, preferably in five components, to permit of determination of the location or point of attack of the resultant. Secondly, pressure-distribution measurements. This group of measurements is the most interesting and the most valuable and it is unfortunate that they are seldom made. Whereas the weighing gives the resultant of all of the forces acting on the model, these tests give the individual components and often result in unexpected explanations of puzzling observations. The third group of measurements consist in an exploration of the surface of the model with streamers of suitable length, and the air-flow as a whole can be recorded photographically.—Max Schirmer in *ATZ* of April 10.

Streamlining of Racing Cars

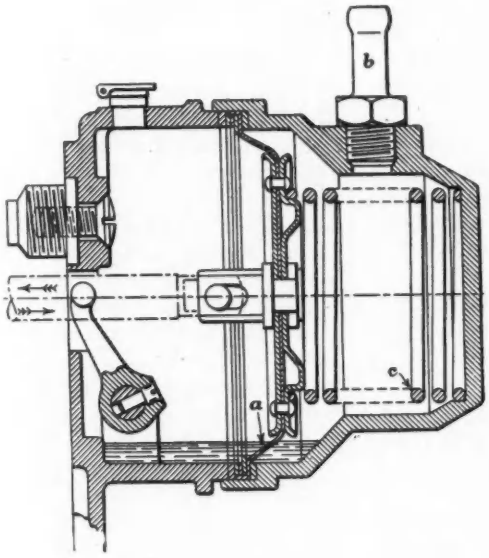
IN a second paper on the streamlining of automobiles presented to the French Society of Automobile Engineers by M. Jean Andreau, reference is made to the requirements of modern racing cars. The most advantageous design from the aerodynamic standpoint seems to be one of the



Auto-Union type, with the powerplant at the center and the driver in front (one-man car). M. Andreau claims that such a vehicle, in accordance with the sketch reproduced herewith, with a horse power of 250 would permit of a speed of 250 m.p.h., that is to say, 62 m.p.h. more than that attained by the Auto-Union, which is already well streamlined. It would also permit of increasing the acceleration, at 125 m.p.h. for instance, by about 40 per cent. The aerodynamic stability of the vehicle could be good provided it had a sufficiently developed tail fin, which could be readily checked by the laboratory. M. Andreau mentions in this connection that a Caudron plane, which with an engine of 380 hp. has a speed of 313 m.p.h., at 250 hp. still has a speed of 270 m.p.h. Consequently, it is much faster than our present one-man racing automobiles and is even a little better than the racing car here discussed.—*Journal of the French Society of Automobile Engineers* for January.

Bosch Pneumatic Governor for Diesels

IN our report of the commercial vehicle show in Berlin during the early part of the current year, mention was made of the fact that a pneumatic governor for Diesel engines had been developed by the Robert Bosch Company. This governor was again exhibited at the Leipzig spring fair and the accompanying sectional view of the governor



is reproduced from a report of that exhibition in *Engineering* of London.

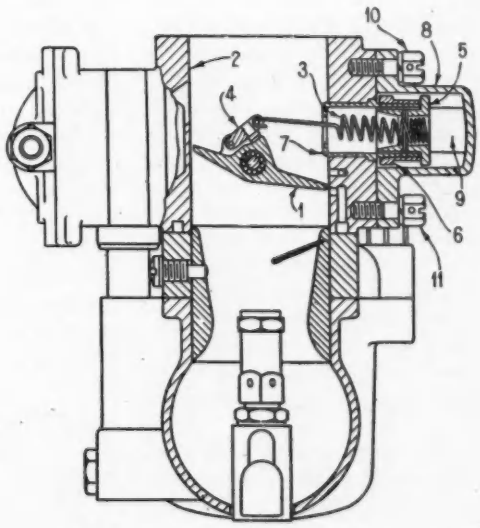
In the past, the regulation of the quantity of fuel injection and the limitation of the maximum and light or idle-running speeds of large and medium-sized Diesel engines have generally been achieved by means of centrifugal governors which are positively driven with the pump. The drawback of this kind of regulation is that, in case of the lower speeds and irregular running of the engine, the fuel quantities delivered are not exactly uniform, although the position of the hand lever or pedal is not altered, and that, even at high speeds, the accuracy of the governing is imperfect. These drawbacks are the more pronounced the smaller the engine and the higher the speed. In the new Bosch system, regulation is based on the principle of using the vacuum in the air pipe for actuating the control rod of the injection pump. The pneumatic governor essentially consists of a diaphragm body secured to the pump as a substitute for the centrifugal governor, and a valve connection attached to the mouth of the air pipe immediately behind the air cleaner, the diaphragm body and valve being interconnected by a pipe.

Referring to the sectional view, the diaphragm *a*, which is made of elastic leather, subdivides the interior of the body into two chambers. One of the latter is permanently open to the atmospheric pressure, while the other, tightly sealed, is connected with the suction valve through the fitting *b* and the pipe already referred to. The coil spring *c* tends to move the diaphragm towards the left, and to set the control rod of the pump linked to it for full load. A throttle incorporated in the suction valve is normally held closed under spring pressure, forcing the throttle valve against a stop. Opening is effected in the usual way by actuating the accelerator pedal.—*Engineering*, May 3.

New Solex Carburetor Has Built-In Inertia Governor

THE socalled gas-inertia type of governor is well known in this country, being used to a considerable extent on trucks which are not equipped with governors by their manufacturers. A European carburetor manufacturer, Solex, now has incorporated a governor based on the same principle in his carburetor, using the regular throttle valve for governing purposes. Referring to the sectional view, it will be seen that the throttle disk is offset and mounted on needle bearings. The offset is in such direction that the moving charge always tends to close the throttle, while a spring in tension tends to hold it open. The throttle hand control is so arranged that the throttle can only be closed by it.

The throttle spindle is of stainless steel and at one end carries a sleeve fixed thereon, which has a bearing in the ordinary throttle-chamber bushing. The throttle lever is secured to the outer end of this bushing, whose inner end has clutch jaws formed on it which engage with similar jaws on the end of the throttle disk. Sufficient clearance is allowed between the two sets of clutch members so that the throttle may be closed by the governor while the manual control is in the "open" position. The link 4 is pivoted to the throttle disk and during the early part of the closing motion swings freely around its fulcrum on the disk; toward the end of the motion it ends up against a boss on top of the throttle disk, and from this point on the relation between the spring extension and the disk motion ceases to be linear. The retracting force is increased and a considerable increase in closing force is necessary from this point on. The governor characteristics can be varied by means of the threaded adjusting member 6 which when screwed further out stiffens the spring and thus increases the governed speed.—*The Automobile Engineer* for April.



Solex governing carburetor

The Forum—

Do Our Cars Lack High Speed Road Holding Ability?

EDITOR *Automotive Industries:*

I have read with interest the article published in your issue of May 11, in which you review certain parts of a paper on Road Performance which I recently presented before the Institution of Automobile Engineers.

In this article you have picked out the relative figures given in my paper in the form of a comparison between American and British cars. Such a comparison was not the primary object of the paper, but, nevertheless, makes interesting reading. These figures, however, only cover measurable aspects of performance, such as acceleration, speed and fuel consumption. There remain many aspects of car behavior which are of great importance to the driver and ultimately to the success of a car, although they cannot be measured by watch or meter.

An expression of personal views upon these non-measurable factors—notably riding comfort and controllability—form rather an important part of my paper and one which may be of interest to your readers. Engineers in England show a proper appreciation of the acceleration, speed and riding comfort of American cars, but we are sometimes surprised at the relatively low standard which seems to be acceptable in the United States with regard to steering and stability at speed. No doubt the difference in road conditions in the two countries is largely responsible for this result. The fact remains that there is a basic difference in road behavior between, say, a British car and an American car each capable of 80 m.p.h. which is not altogether easy to explain.

It would be interesting to hear your readers' views on the following relevant quotations from my paper:

"Riding comfort is sacrificed on the altar of road holding in most British cars at the present time. Conversely—and again with reservations—the Americans revere principally the boulevard ride. It is sincerely to be hoped that their boulevards are free from bends."

"It is questionable whether the capabilities of a car for speed should ever be allowed to outstrip the development of the steering and suspension systems."

It seems to me that most modern cars present a compromise between comfort and controllability out of which must be developed new designs embodying each of these desirable characteristics in a proper ratio.

MAURICE PLATT,
Technical editor, *The Motor*,
London, England.

We submitted Mr. Platt's communications to a number of our readers, and following are some extracts from their replies:

"It is my opinion that riding comfort in most British cars is sacrificed completely in the interest of handling and appearance. Many of the English sports cars have an amazingly small amount of jounce space in order to achieve low seating and low overall height. The type of ride common to English vehicles would never be acceptable in this country, and the curious part of it is that, whereas they go to such lengths to provide good handling, many of the cars, at least, have so little actual speed as to make it seem an unnecessary provision. The small sports type cars which are so popular in Britain make a tremendous fuss, ride miserably, and yet have no acceleration or maximum speed.

"The type of road common to Britain undoubtedly is an important factor in the design of their cars. If I am not mistaken, Maurice Olley, in a paper presented at one of the S.A.E. meetings, pointed out that the type of ride common to American cars provides better handling on American concrete highways than would the more rigid suspension of British cars. I suspect you would find some interesting material relating to this subject in Mr. Olley's paper."

Here are the comments of another reader on the questions raised by Mr. Platt:

"There certainly is a basic difference between American and European roads. American rough roads and even American good roads are 'long wave.' European roads are 'short wave.' It is also true, of course, that American roads in general have long straights, large-radius, banked curves, not much camber and adequate width, whereas, especially in England, there is a prevalence of narrow, winding roads, with sharp, blind turns, and high crowns. Average touring speeds and daily touring mileage are much greater in the United States than elsewhere.

"The English critics always make the mistake of believing that American cars are sprung for a boulevard ride. They actually *have* to be sprung much softer than European cars to get a good ride on our road surfaces even at our very high touring speeds.

"Again, with regard to steering, the English and European manufacturers generally admire 'nimbleness' in a steering more than anything else. In view of their roads this is understandable. Their thought on steering is to get round a sharp bend with minimum effort. Our thought in the steering of cars in this country is, first of all, to get round a long bend at high speed with the car under absolute control; secondly, to go down a straight road in a cross wind without swerving.

"The difference in our ideas is therefore very marked. When we speak of a car being 'unstable' on the road we generally mean that it oversteers, i.e., turns faster than the driver has reason

to expect from the amount of movement of the steering wheel. In the English cars it appears that this tendency to oversteer is not regarded as a disadvantage to anything like the same extent as it is here.

"In certain parts of this country there is a prevalence of heavy winds. To be able to handle a car safely on long, straight roads in a gusty cross-wind—often with considerable traffic in both directions—it is essential that the car shall have an absolutely stable sense of direction. This has nothing to do with what the English call 'road-holding,' which appears to be concerned chiefly with keeping the wheels on the ground by stiff springs and shock absorbers.

"What this amounts to is that Mr. Platt is absolutely right when he says that difference in road conditions in the two countries is responsible for the differences in practice."

And here are the comments of a third reader, a well-known chief engineer:

"For many years Englishmen claimed to know a lot about making automobiles ride. They have had very few good-riding cars in England except ultra-luxurious cars.

"When it comes to roadability of American cars, they have to be divided into two classes. Most of the cars in which they shoved the engine way ahead, in order to get more comfortable (?) seating for the passengers, have utterly lost high-speed roadability, which is to be expected; but there are, nevertheless, cars built in the United States today which are very excellent high-speed road jobs.

"On the other hand, a lot of American cars have gone independent suspension, and have soft front spring rates, and don't handle well on turns; and those jobs in which the engine has been pushed up pretty well over the axle in order to give different weight distribution, and what is alleged to be (and possibly is) better passenger seating, have absolutely lost the high-speed balance of the car on curves and on rough going. So, the Englishman's question cannot be answered in a sweeping manner on American cars, any more than on English cars, because I have found some English cars that ride very well.

"The interesting thing, of course, is that in England there are few places where anybody can drive 'all-out' for any distance. If there are places, I have never found them, because, even in the wilds of Scotland, Northumberland, Wales and Derbyshire, you can no more than get up to speed when you are in another village. When they talk about high-speed driving, outside of the Brookland race track, it is just pathetic because they do not have it.

"If any nation in the world ought to have rapid acceleration in its cars, lots of get-away, with very little demand for maximum high speed, it is England, because it is not a country in which high speed is of any use, but it is a country in which acceleration means more in saving time than maximum speed.

"The answer to the thing is—the Englishman designs his car and uses it more or less to satisfy his imagination and his Anglo-Saxon instinct. He wants to live in a realm of things as they ought to be, and not in a realm of things as they are. Whereas America is rapidly evolving automobiles to suit the conditions as we find them."

The following comments were received from another engineer:

It has been a very slow process in educating the buying public to accept a soft sprung car for high speeds. The progress of education has been slower in Europe than in America.

May I review to you the major steps taken in the development of the suspension since the advent of the pneumatic tire?

When the pneumatic tire first made its appearance cars were slow—tires had fabric side walls and they were definitely the weakest link in the picture. The automobile springs were softer than the buggy springs just preceding them, which were balanced to the solid rubber tires of the buggy. With the coming of the cord tire it was possible to slightly lower the air pressure and with it it was possible to lower the stiffness of springs and thereby increase the comfort. Already at that time car speeds had been boosted and questions about security on softer sprung cars were continuously raised.

Now a little over ten years ago the balloon tire became generally used. With them we came to relatively soft springs and almost universal usage of shock absorbers. It was a real battle to put over these improved rides with fast drivers, but it was sold, and it was generally accepted both in this country and abroad on or about 1928.

There was really no progress of any importance from that time until the super-balloon tire came and with it a demand for still softer springs. With the softer springs steering difficulties developed and forced the advent of the independent suspension. In the meantime the old suspensions caught up, new materials were developed and improved methods of steering engineered, so today it is possible to have a very soft sprung car on the super-balloon tires as you know them today.

The American public is very well sold on these soft suspensions and prefers a ride which causes little fatigue to one that gives apparent security. Remember that in all cases our American cars are safe at remarkably high speeds.

Really, I believe that Mr. Platt is what I would like to call a "die-hard" defender for the stiff suspension.

Only last week I was informed that one of the largest English companies is preparing a suspension in which the static deflection of the front spring will be 5½ in., which compares very favorably with the suspension in our best riding automobiles today.

Ternstedt artisan fashioning a four-cavity die for a door handle die casting

White 32-passenger city coach

Above, White interurban with streamlined body

Rear and Increasingly

THE latest production of the White Company in the line of passenger-transportation equipment is a 32-passenger city coach. It is of the street-car or transit type, having the 12-cylinder engine with its unit clutch and transmission underslung from the coach frame at the center.

Passenger-car performance is claimed for this new coach, which is equipped with a 12-cylinder horizontal opposed engine of 3⅝-in. bore by 3¾-in stroke. The piston displacement figures out to 465 cu. in. The engine is equipped with a centrifugal governor which is set to control its speed at 2400 r.p.m. A single-reduction rear axle is used. but three different reduction ratios, of 4.7, 5.11 and 5.71, are being offered. Standard tire equipment on the driving wheels is 7.50/24-in. (dual), which makes the effective wheel diameter 38 in. Bus speeds corresponding to the governed engine speed of 2400 r.p.m. figure out to approximately 58, 53, and 47.5 m.p.h.

Without passenger load but with supplies ready for the road the bus weighs approximately 15,000 lb. Figuring passengers at 150 lb. each, this makes the loaded weight for a full complement of seated passengers 19,800 lb. The displacement figures in cu. in. per ton-ft. then figure out as follows for the empty and loaded bus and for the three different rear-axle ratios:

Rear axle ratio	Displacement Factor Without load	With full load
4.70	13.9	10.5
5.11	15.1	11.5
5.71	16.9	12.8

The engine, as already mentioned, is of the flat or pancake type, and is therefore low in height. Its general arrangement is similar to that of the powerplant on the White 44-passenger type city bus brought out some years ago, and an illustrated description of this new powerplant has already appeared in these columns (see *Automotive Industries* of Oct. 13, 1934). All accessories are grouped together at the front of the frame, where they are more accessible. This accessory unit includes the water pump, air compressor, generator, fan and transmission control. It is driven from the front end of the crankshaft through a short drive shaft. The clutch and transmission are built in a unit with the engine, to which they are flange-bolted. The clutch, which is air-controlled, is of the two-plate, in-oil type.

The transmission is a three-speed design, of the constant-mesh type, with all forward speeds silent. In order to limit the depth of the transmission below the crankshaft axis to that of the lowest part of the engine, the axes of the two shafts are located in an inclined plane. Back of the transmission there is a four-shoe, disk-type emergency brake with an outside diameter of 16 in. and an inside diameter of 10 in. The rear axle is of the full-floating type, with single reduction by spiral bevel gears.

Service brakes act on all four wheels and are air-operated. Brake shoes are fitted with molded lining and act internally on gun-iron drums. All four brakes have an effective diameter of 16½ in.; front brakes are 4 in. wide, rear brakes, 4½ in. The total braking area of these brakes is 587 sq. in. The fuel tank, which has a capacity of 65 gals., is mounted under the floor at the rear of the coach.

This bus is offered in two body types, both of which have a front entrance, the exit being at the rear in one design and at the center or immediately forward of the rear wheelhouse in the other. Seating arrangements differ somewhat with the location of the exit, more seats facing forward in the rear-exit type. In addition to seating 32 passengers, the coach affords room for 40 standees.

The body of the new White city coach is built of aluminum alloy and steel, with the exception of the flooring and the roof, which contain wood. Body sides below the windows form carrying members, each side member being a plate girder 25 in. deep. There are heavy transverse box girders at the rear end of the front springs and at both ends of the rear springs, through

which the passenger and body load is transferred to the springs and axles.

The bus comes in two lengths of wheelbase, a wheelbase of 166 in. being used for the rear-exit body and 182 in. for the center-exit body. With the rear-exit body the coach has an overall length (over the bumpers) of 27 ft. 1 in., while its overall width is 96 in. With standard tire equipment of 9.75/20 tires on Budd front wheels, the tread at the front wheels is 80⅝ in. and with the standard equipment of 7.50/24 in. tires (dual) on Budd rear wheels, the rear tread is 68⅛ in. With the bus loaded the height of the front step from the ground is 16 in. and the height of the floor above the front step 12½ in.

In addition to the city bus described in the foregoing we show herewith a photo of the latest type of White interurban bus, which has the engine mounted at the front. It will be seen that this vehicle has rather well developed streamlines.

The latest bus model of Reo Motor Car Co. is the 2L-M, a forward-control vehicle specially designed for city operation and short suburban runs. In this model the steering gear and controls are located forward of the front axle, while alongside of the engine there is a raised platform for the driver's seat. This arrangement allows of the use of a St. Louis-type bus body accommodating 22 passengers. The wheelbase is 166 in. and the overall length, 241 9/16 in. A double-drop frame is used, and with a normal load the floor height above the ground is 23-11/16 in.

This bus has a gross-load rating of 12,500 lb. and since it accommodates 22 passengers, the unladen weight is 9,200 lb. The engine has a displacement of 268 cu. in., the tire equipment is 6.50/20 (effective diameter, 32 in.), and the standard gear ratio is 5.28 to 1. This gives a displacement factor of 17.4 cu. in. per ton-ft. for the empty bus and 12.8 cu. in. per ton-ft. for the bus with a full complement of passengers. At 2800 r.p.m. of the engine the speed of the bus is 50.5 m.p.h.

Like other Reo buses, this model is used as a school bus in various localities and will accommodate up to 60 pupils.

It is not unlikely that one of the next developments in bus engineering will be the adoption of a type of transmission which does not require multiple mechanical linkages from the driver's seat at the extreme front to a powerplant at the extreme rear. The electrical drive, of course, meets this desideratum but is handicapped in other respects. A number of semi-automatic mechanical transmissions have been developed in which a change of gear is effected by the reversal of the torque or by a change in engine speed when the driver releases the accelerator pedal or throws out the clutch, which would seem to offer particular advantages in vehicles where direct mechanical transmission involves cumbersome connections. As the field for buses in public transportation is constantly widening and as competition is getting keener all the time, there is every probability that the engineering development of the vehicle will continue at a rapid rate.

Under-Chassis Engines Popular in Bus Field

Part IV

by P. M. Heldt
Engineering Editor, Automotive Industries

Chassis of Reo bus with driver's seat alongside the engine

Left, Reo school bus for 60 pupils

Keller Is Chrysler President

(*Continued from Page* 95)

prenticeship course with Westinghouse, in 1909, he was made assistant to the superintendent of that company's automobile engine department. The next year found him chief inspector of the Detroit Metal Products Co., manufacturer of automobile axles. Later in the same year he became general foreman of the machine shop of the Metzger Motor Co. Subsequently he was with Hudson and with Maxwell. In November, 1911, he joined the central office staff of General Motors where he first met Mr. Chrysler. He was promoted to the superintendency of Northway Motors in 1915. He next was associated with Cole for a short period but returned to GM as general master mechanic at Buick under Mr. Chrysler, who was then president of that company. He returned to GM's central office staff in 1919 and in 1921 became vice-president in charge of Chevrolet manufacturing and in 1924 general manager of GM's Canadian operations. Then in 1926 he joined Chrysler, becoming president of Dodge in 1929 as well as vice-president in charge of all Chrysler manufacturing.

Mr. Hutchinson has taken an active part in the financial and corporate affairs of Chrysler and its predecessor companies since he became treasurer of Maxwell in 1921 when Mr. Chrysler began to rehabilitate that company as the forerunner of his own enterprises. One of his first jobs as treasurer of Maxwell was to sell the bankers that the company was a good credit risk. He was born in Chicago in 1888 and finished his schooling at M. I. T. Following varied experience in the steel industry and in accounting, Mr. Hutchinson joined Maxwell in 1921 as treasurer and shortly became vice-president as well. Then in 1924 he became vice-president and treasurer of the Chrysler Corp., and soon thereafter a director and member of the finance committee. He has also been Plymouth chairman as well as vice-president and treasurer of the Dodge and DeSoto organizations.

Mr. Zeder, together with Carl Breer and Orin Skelton, is credited with the design of the first Chrysler car introduced in 1924. He was born in Bay City, Mich., in 1886 and is a graduate of Michigan in mechanical engineering. His first connection in the industry was with E.M.F. In 1913 he became consulting engineer for Studebaker and later its chief engineer, relinquishing that post in 1920 to organize the Zeder-Skelton-Breer Engineering Co. Messrs. Skelton and Breer are now executive engineers at Chrysler. When the Chrysler Corp. was formed, Mr. Zeder became vice-president in charge of engineering and since that time has been in full charge of engineering for all divisions.

Mr. Davies, the new treasurer, has been assistant treasurer since 1922, and has been chiefly concerned with treasury operations and its financial relations with distributors and dealers. He was born in 1888 in Wales, coming to this country in 1908. In 1910 he entered the accounting department of United States Motors, predecessor of Maxwell.

"Under the management," Mr. Chrysler said, "of these men and their associates in the management group, notably J. E. Fields, head of the Chrysler division, Byron C. Foy, head of DeSoto, W. Ledyard Mitchell, in charge of exports, and A. C. Downey, Dodge trucks, this business has assumed its progressive character."

Summer Sales Firm

(*Continued from Page* 95)

Used car business is irregular. Increasing sales and declining stocks are reported from some quarters while others are intensifying pressure on dealers to move stocks. One leading company is offering factory cooperation on used car advertising in newspapers, each zone manager being allowed a budget for this purpose. The factory shares part of the advertising expense provided the dealer complies with certain requirements such as marking down prices to attractive figures, proper reconditioning and adequate sales promotion.

The estimate of 300,000 cars and trucks or more for July still stands. Some plants are doing slightly better than anticipated. Instead of a letting down by mid-month as had been looked for the earlier production rate is being maintained and in a few instances bettered. The latter are crowding into July the tag ends of the current run so as to be able to cut off sharply in August.

Officials in charge assert that 4000 motorists drove new Plymouths home from the factory during the first six months this year. They declare that the retail customer driveaways have climbed to an average of 1500 units monthly this summer as more and more tourists and vacationists take advantage of the opportunity to pick up their own cars at the factory. With this increased business, the Plymouth factory has enlarged the department set-up to take care of the retail buyers. The new car service department, where every car is given special servicing before it is turned over to the customer, has been increased in size.

Oldsmobile

Sales for second 10 days of July, 4547 units. . . . For the year (up to July 20), 95,060. . . . Additional sales figures carry total to 95,837, represents entire total for year of 1929.

Plymouth

Retail deliveries, week June 20, 8736. . . . Compares with 8207 corresponding week last year. . . . Increase of 6.5 per cent. . . . First 29 weeks dealers delivered 241,419 cars compared with 185,545 same period 1934. . . . Gain of 30.1 per cent. . . . Used car stocks reported declining, present equivalent to 4.8 weeks' supply.

DeSoto

Dealers delivered 2782 Plymouths and 696 DeSotos week ended June 20, total 3478 units. . . . Compares with 3274 units preceding week. . . . Year-to-date deliveries 76,332 Plymouths, 15,978 DeSotos. . . . Respective gains of 34.4 per cent and 167.9 per cent. . . . Combined deliveries 92,310 units against 62,774 year ago, increase of 47.1 per cent.

Chrysler

Dealer deliveries, 3384 Plymouths, 935 Chryslers, 4319 total units, week ended July 20. . . . Compares with 3868 Plymouths, 1001 Chryslers, total units, 4687, in preceding week. . . . Respective gains of 6.7 per cent, 41.7 per cent, 12.7 per cent. . . . Year-to-date deliveries, 93,084 Plymouths, 26,474 Chryslers, total 119,558 units. . . . Gains of 3.9 per cent, 85.3 per cent, 40.9 per cent respectively over similar 1934 period.

Dodge

Dodge deliveries week ended July 20, 3968 Dodge passenger cars, 2570 Plymouths, 1137 Dodge trucks, total of 7675 units. . . . Compares with 7639 units for preceding week. Deliveries first 29 weeks of year 112,078 Dodge passenger cars, 72,003 Plymouths, 30,864 trucks, total of 214,945 units against 140,932 units in corresponding 1934 period. . . . Domestic shipments from plant, 122,782 passenger cars. . . . Production continues at 800 cars per day, five-day week.

Graham-Paige

Sales running at rate of approximately 2000 cars this month. . . . July production schedules call for 1518 cars against 1750 shipped in June.

Pontiac

July production expected to exceed number first scheduled. . . . Should near June output of 17,607 units.

Famous Speedway Remodeling Begun

Greater Safety at Turns Under High Speeds Aim of Reconstruction Plan

Work started Thursday at the Indianapolis Motor Speedway to remodel the curves which have been the scenes of many fatal accidents in the 24 years of the track's existence. E. V. Rickenbacker, president of the speedway corporation, said that approximately $100,000 will be spent.

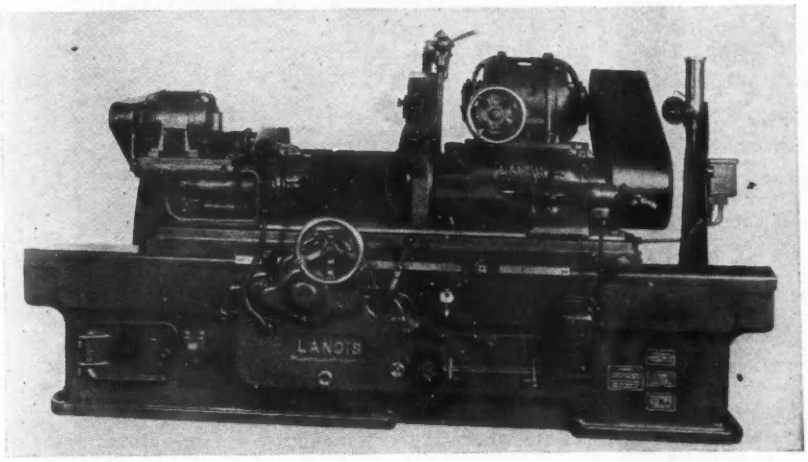
Captain Rickenbacker said that experts in racing and construction were consulted before work begun, so that the remodeled track will care for the needs of cars for another score of years. He intimated that his organization feels the track still is adequate for present needs, but eventually speeds of 120 m.p.h. for the full 500 miles will obsolete the bank of the curves.

T. E. Myers, vice-president and general manager of the corporation, said steam shovels would begin the work by digging away the outside 10 feet of brick at each of the four corners. Immediate work will be the reconstruction of the outside of the four turns, the resurfacing of part of the turns and the construction of an entirely new type of retaining wall on the outside of the turns. Also under consideration is the expansion of the safety zones on the inside of the corners. Particular attention will be paid to the middle parts of the curves and the bricks will be relaid to conform with the new outside developments.

NEW DEVELOPMENTS
Automotive Parts, Accessories and Production Tools

Landis Hydraulic Grinding Machines

Landis 10 in.-14 in. and 16 in. Type D Plain Hydraulic Grinders embodying many new features of design have been placed on the market by the Landis Tool Co., Waynesboro, Pa. The 10 in. and 14 in. sizes may be used for the grinding of spindles and shafts of many types and sizes. These same machines are ideal for grinding crankshaft line bearings, camshaft main bearings and motor armatures. The 16 in. sizes may be used instead of the 10 in. and 14 in. sizes for the grinding of many of the foregoing parts which might require a machine of greater swing. Because of the weight, size and power of the machines, they may be used for wide wheel and multiple wheel grinding.



A 30 in. diameter grinding wheel is considered standard. Provision has been made, however, for the use of a 36 in. diameter wheel on 10 in. machines, or a 42 in. diameter wheel on 14 in. and 15 in. machines. These larger diameter wheels are especially desirable where crankshaft line bearings are to be ground as their use considerably decreases wheel truing and wheel changing time.

Hydraulic system is of the dual cylinder type. It provides a wide range of work table speeds with smoothness of traversal at any speed between the minimum of 6 in. per minute and the maximum of 240 in. per minute. Due to the use of dual cylinders (one for movement in each direction) the volume of oil in each is constant and the speed is therefore constant in both directions. Table speeds are regulated by a convenient valve which governs the flow of oil from the end of one cylinder to the corresponding end of the other. The hydraulic straight in-feed mechanism is available, although it is not considered standard equipment.

The final work drive, that is, from the jack shaft to the face plate, is through multiple V belts. The work drive motor is of the constant speed type, a range of 65 to 200 r.p.m. being available simply by the changing of an easily accessible belt and pulleys at the end of the headstock.

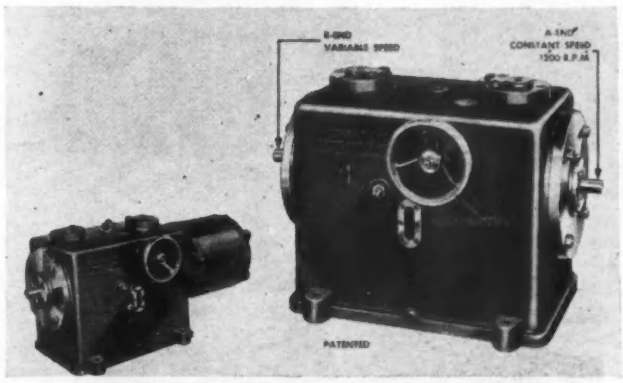
The lower portion of the bed is cut out in front, giving toe room so that the operator may conveniently get close to the machine. In addition to this, the various controls are fitted snugly against the bed and covered with one smooth cover. All of the hydraulic controls are at the front of the bed, behind one cover.

The machines are offered in hydraulic or hand traverse, in swings of 10 in., 14 in. and 16 in. and in lengths of 18 in., 36 in., 48 in. and 72 in. The wheel drive motor is either a 20 or 25 hp., depending upon the wheel used. The pump drive motor is 3 hp. and the work drive motor either 1 or 1½ hp. depending upon the swing. All are constant speed motors. Weight of the machine, the 10 in. x 36 in size, for example, is 12,850 lb., net.

Vickers Hydraulic Variable-Speed Transmission

A variable-speed transmission of the hydraulic type, for industrial purposes, has been placed on the market by Vickers, Inc., Detroit, Mich. It is in the form of a rectangular box with the input shaft centrally at one end and the output shaft at the other end. It is designed to have a 1200 r.p.m. electric motor direct connected to the input end. Any desired speed between 5 and 750 r.p.m. can be obtained by turning the handwheel at the side of the transmission, which has the effect of varying the stroke and delivery of a multiple-piston-type pump. Additional adjustments permit speeds up to 2500 r.p.m.

Both ends can be provided for either direction of rotation, and direction can be changed after installation without difficulty and without the need for additional parts, it is claimed. Units now in production have capacities of 6 hp. at 1000 r.p.m. and 7½ hp. at 1250 r.p.m. Larger sizes are under development. The overall dimensions of the unit referred to are 25⅞ by 17⅛ by 17½ in. Oil is used as the working fluid and all parts are self-lubricating.



Vickers hydraulic industrial transmission

Cincinnati Unit Center Type Grinder

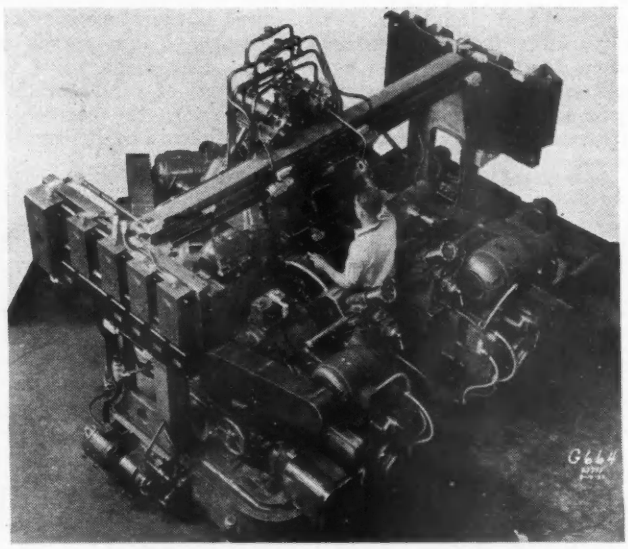
A special purpose grinding machine, that by means of unit construction may be adapted to change in design of the manufactured product, is one of the recent contributions to high production precision grinding by the Cincinnati Milling Machine and Cincinnati Grinders, Inc., Cincinnati, Ohio. Although the set-up was designed for grinding four surfaces on automobile axle shafts, plunge cutting operations may be carried on either singly or in multiple on a variety of work carried between centers. Operation, however, must be on a quantity production basis, for although the machine is of the unit type, and can be changed over to accommodate reasonable changes in work shapes, it would not be economical to consider making this change-over at periods less than 600 working hours.

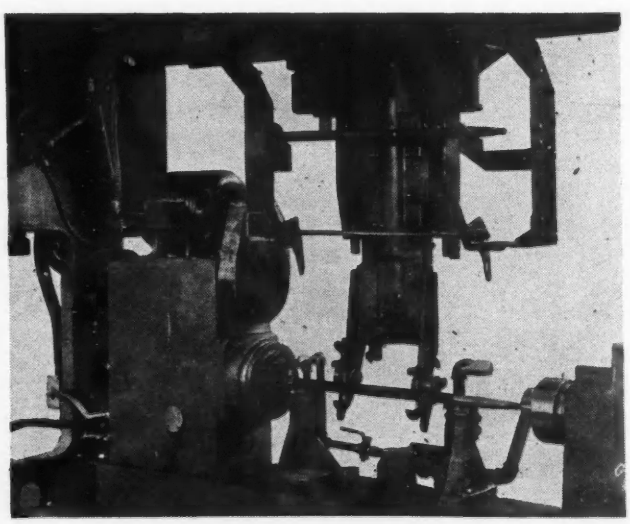
Wheel heads are built up in units and equipped with 30-in. diameter grinding wheels. Hydraulic truing arranged for either rotary or diamond truing tools is supplied for each grinding wheel. Power in feed motion of the grinding wheel is obtained by a cam which is rotated by a small motor mounted in the sub-base of the wheel head. As the cam is rotated the wheel head tilts about a pivoted bearing. Compensation for wheel wear is obtained by means of a hand-wheel to the wheel head base which is provided with a dovetail slide. Compensation for wheel wear is also obtained by suitable push button control mounted on a panel board above the loading attachment. Each time the push button is depressed, the grinding wheel feeds in .0001 in.

The cycle of operation, as performed in the axle shaft application, is as follows: the operator places the axle on the loading cradle and throws a single lever to start the machine; the axle is lowered to the working position and picked up by the centers of the footstock and headstock. The action of the centers moving in causes the closing of the two limit switches which in turn start up all four of the grinding wheel head cam drives. The grinding wheels are moved in to the proper depth, allowed to dwell and then withdrawn to the starting position by means of the cam control mechanism. The final retraction of the grinding wheel opens a set of limit switches on each wheelhead which closes the complete electrical circuit which in turn operates a hydraulic valve that retracts the centers of the footstock and headstock, then the work is lifted up hydraulically to an unloading chute where it is removed by the operator.

When operating under production conditions, the cycle is automatic, and the operator has only to load the machine, remove the finished work, gage the work and make occasional compensations for wear of the grinding wheel.

Four surfaces finished complete from the block, with a production of 80 axles per hour. One man can operate two machines.





New Total Time Meter

For totalizing running or idle time on electrically operated machinery including machine tools, welders, electric signs, refrigerators, radio transmitters or any individual a-c powered unit, Westinghouse Electric Mfg. Co., East Pittsburgh, Pa., announces the Total Time Meter. The registering mechanism has four dials and will register 9,999 hours before repeating, approximately 400 days. If desired, the meter can be mounted in the Superintendent's or Foreman's office connecting it to the machine by a single pair of wires.

The Total Time Meter including the self-starting, 120-volt, a-c., 60-cycle synchronous motor is contained in a two-piece Moldarta case having a flange diameter of 3½" and overall length of about 3¼". The motor is of the slow-speed, sub-synchronous type, with jewelled bearings.

The 11-volt and 120-volt styles require approximately 1.5 watts for operation. The 240-volt style requires approximately 3 watts. The synchronous motor will stay in step with voltages 12 per cent above or below normal values.

The meter can also be furnished with a special register providing one revolution per hour of the sweep hand. The sweep hand dial is then marked in 10 main divisions each of which represents 1/10 of an hour.